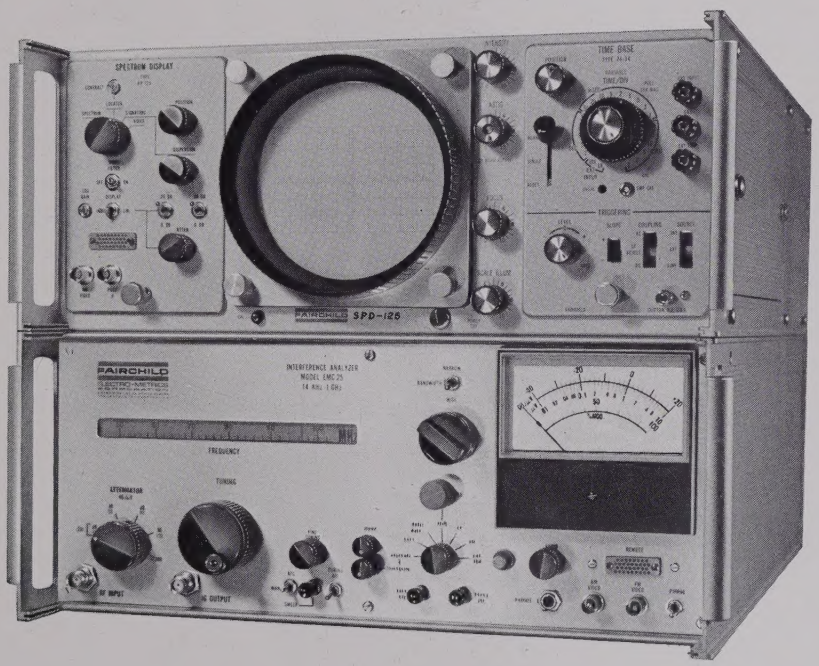
INSTRUCTION MANUAL

CALIBRATED SPECTRUM ANALYZING RECEIVER



MODEL CSR-200

(Including Model SPD-125 Spectrum Display Module)

FAIRCHILD

ELECTRO-METRICS
CORPORATION
A SUBSIDIARY OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

AMSTERDAM, NEW YORK

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ISSUED NOVEMBER 1, 1967

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NOTICE

The Calibrated Spectrum Analyzing Receiver Model CSR-200, is comprised of the Spectrum Display Module Model SPD-125, Interference Analyzer Model EMC-25, and interconnecting cables.

The Spectrum Display Module Model SPD-125 is comprised of the Spectrum Display Plug-In Model PP-125, the Time Base Plug-In Model 74-14 and the Oscilloscope Main Frame Model 767-H.

Under cover of this document is contained three instruction manuals, one for each of the units which comprise the SPD-125 Spectrum Display Module. Each manual is self-contained. The manual for the PP-125 Spectrum Display however, contains specific information concerning its operation as part of the CSR-200. Manuals for the Time Base Model 74-14 and for the Oscilloscope Main Frame Model 767-H contain information on these units only, without reference to their relationship in the CSR-200.

Information concerning the operation, maintenance and repair of the EMC-25 Interference Analyzer is contained in a separate manual.

SECTION I
INTRODUCTION

1.1 THE MANUAL

This manual includes relevant information for the successful operation, maintenance and repair of Spectrum Display PP-125. Information related to the operation, maintenance and repair of the 767-H Oscilloscope, Time Base Model 74-14, and Interference Analyzer EMC-25 is referenced in their respective manuals.

Special attention is directed to Section II, Theory of Operation. A thorough understanding of this section will enhance the performance of troubleshooting procedures. Section III relates to the operation of the equipment. This section is intended as an aid to both operating and maintenance personnel.

1.2 THE SPECTRUM DISPLAY PP-125

The Fairchild Spectrum Display PP-125 is a special purpose plug-in for the Model 767-H oscilloscope.

Special front panel controls permit video presentation of all or a portion of the spectrum being analyzed. Zero to 40 DB attenuation, gain control, choice of linear or logarithmic display, video filtering, position, and function switching are controlled from the front panel. Inputs for AM VIDEO and POST IF from the EMC-25 are also front panel located.

Internal adjustments located on the sweep control board (A1A4), IF (A1A1 through A1A3) and video (A1A5) are preset for use with a given CSR-200 system.

1.3 SPECIFICATIONS

1.3.1 See the EMC-25 manual for full data on the Model EMC-25 Interference Analyzer.

Display Range: 14 KHz - 1 GHz
Sensitivity: As specified for EMC-25

1.3.2 The following characteristics relate to the PP-125, as part of the Calibrated Spectrum Analyzing Receiver, CSR-200.

Display Characteristics (6.3 cm full scale deflection):

Mode	Scale Factor	Accuracy
LINEAR	Relative Voltage/Div.	±3% Full Scale
LOG	10 DB/Div. calibrated -40 to +20 DB on CRT display	±2 DB Absolute

Calibrator: EMC-25 Internal Impulse Generator

Bandwidth: As specified for Model EMC-25

Cathode Ray Tube: 5" flat face post accelerator CRT, 13 kv potential; frame grid gives minimum defocusing and spot size; P-2 phosphor.

Analyzer Plug-In: (Model PP-125)

Main Function Modes

1. SPECTRUM, Octave Range
2. LOCATOR, bright-up section, Octave Range
3. SIGNATURE, Sector Sweep
4. VIDEO

Other Controls

1. DISPERSION: 0.1% to 10% of octave. In LOCATOR and SIGNATURE positions.
2. VIDEO Filter: ON, OFF
3. POSITION
4. DISPLAY: LINEAR or LOG
5. CONTRAST, bright-up display

Time Base Plug-In:	See 74-14 section.
Main Frame:	Includes only power supply and CRT. Will accept any standard Fairchild Instrumentation plug-ins for full use as standard oscilloscope.
Receiving Section:	See EMC-25 Literature. EMC-25R may also be incorporated at customer's request.
Operating Temperature Range:	0°C to 50°C
Power Requirements:	105-130 or 210-260 volts AC 50 - 450 Hz, 210 watts
Dimensions:	14-1/2" H x 17" W x 22" D, Max., complete receiving and display system
Weight:	110 lbs. approx.
Accessory Items Supplied:	Standard EMC-25 accessories, see EMC-25 Price Schedule
Pick-up Devices and Peripheral Equipment (Optional):	Standard Accessory Kit, 14 KHz to 1000 MHz, Model AAK-25A, and/or individually selected items and accessories.

SECTION II
THEORY OF OPERATION

2.1 GENERAL

The Spectrum Display Model PP-125 is a special purpose plug-in, used with the Model 767-H Oscilloscope and the Model 74-14 Time Base plug-in. Combined, these three units comprise the SPD-125 Spectrum Display Module. When used in conjunction with the EMC-25 Analyzer this system comprises the Model CSR-200 Spectrum Analyzing Receiver.

2.2 BLOCK DIAGRAM DISCUSSION (Figure 2.1)

The logarithmically detected AM signal from the EMC-25 analyzer is fed to the log gain control circuits in the PP-125. With the Display Switch in the LOG position, the directly coupled instantaneous log output of the analyzer is delivered to the scope. The scope presentation will then be logarithmically compressed video information.

The IF signal from the POST IF output of the EMC-25 analyzer is fed to an attenuator network in the PP-125. The applicable spectrum display IF amplifier and detector is selected by decoding the four-digit binary data from the EMC-25. Wafer switches located on the shaft of the cylindrical scale of the EMC-25 act as code wheels to form a binary code, which is fed to the IF amplifier logic switching circuits. If any band between 1 and 7 is selected at the EMC-25 analyzer, the 175 KHz IF amplifier and detector channel is gated on. If band 8, 9, or 10 is selected, the 1.6 MHz IF amplifier and detector channel is gated on. If any band between 11 and 15 is selected, the 8.7 MHz IF amplifier and detector channel is gated on.

With the DISPLAY switch in the LIN position, the linearly detected video signal from the selected IF amplifier is fed through a video amplifier and to the CRT, to provide a linear presentation.

The logic switching circuits operate by sensing a level of +2 VDC or greater as a "1" or high condition, and an open circuit as a "0" or low condition. All possible combinations of levels for a four-digit binary code are shown in Table 2-1. As can be seen from the table, the 175 KHz IF amplifier output is on whenever A is zero. The 1.6 MHz IF amplifier is selected whenever A is "1" and B is zero at the same time and either C or D or both are zero. The 8.7 MHz IF amplifier is selected whenever A and B are "1" simultaneously, or whenever A, C, and D are "1" simultaneously. This is expressed in boolean terms as follows:

175 KHz $\overline{A}$
1.6 MHz $(A\,\overline{B})\ (\overline{C} + \overline{D})$
8.7 MHz $(A\,B) + (C\,D)$

TABLE 2-1

BCD CODE FROM EMC-25 ANALYZER

EMC-25 Band	Levels A	B	C	D	PP-125 IF Amp
1	0	0	0	1	
2	0	0	1	0	
3	0	0	1	1	
4	0	1	0	0	175 KHz
5	0	1	0	1	
6	0	1	1	0	
7	0	1	1	1	
8	1	0	0	0	
9	1	0	0	1	1.6 MHz
10	1	0	1	0	
11	1	0	1	1	
12	1	1	0	0	
13	1	1	0	1	8.7 MHz
14	1	1	1	0	
15	1	1	1	1	

The DC tuning voltage from the EMC-25 analyzer and the horizontal sweep voltage from the oscilloscope are fed to the sweep control circuit. These voltages are processed, according to the control settings of the PP-125, and returned to the EMC-25 as the dynamic tuning voltage for the EMC-25.

2.3 CIRCUIT DISCUSSION

2.3.1 175 KHz IF AMPLIFIER (Figure 5.5). The IF input at J3-21 is applied to a preset level control R9. This IF signal is capacitively coupled to the base of Q2. The collector load of Q2 is a tuned circuit composed of L1-C3 and damping resistor R6, resonant at the 175 KHz input frequency. The signal from the tuned

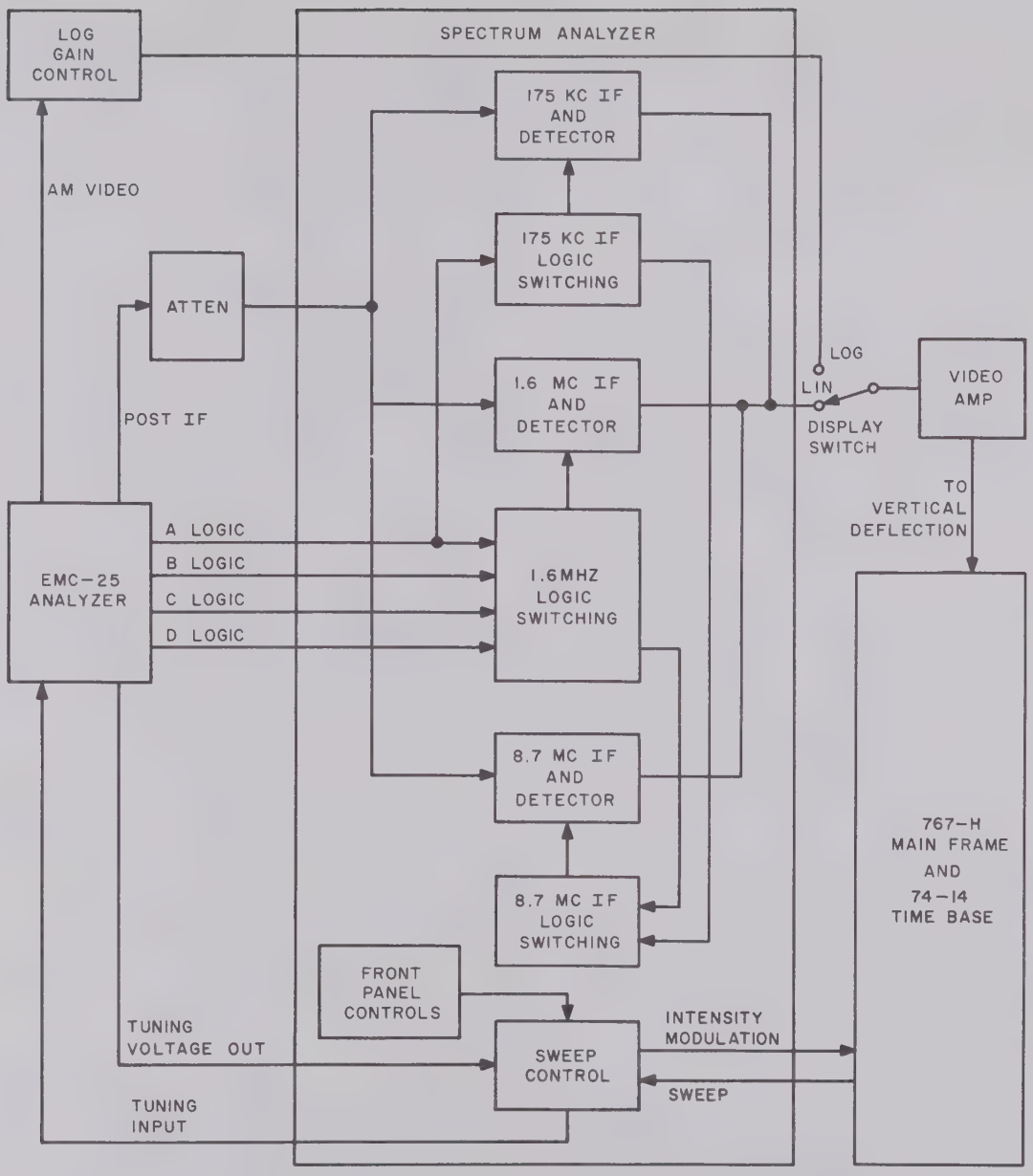


Figure 2.1 Spectrum Analyzer CSR-200, Block Diagram

circuit is capacitively coupled to emitter follower Q3. Its output is in turn fed directly to the base of Q4. Q4 again has a tuned collector load comprised of the primary of T1 and C6 with damping resistor R8. All amplifiers (Q1-Q4) have power supply decoupling networks. Transformer T1 secondary couples the 175 KHz signal to a full-wave detector comprised of CR1 through CR4 and C12/R17 filter. The detected video signal is fed directly to the base of Q6. The 175 KC IF amplifier has been selected by the RF band setting of the EMC-25. If the operational amplifier composed of Q6, Q7 and Q5 is turned ON, this amplifier has a gain of 1, and is used as an impedance match between the detector output, and video input circuits.

A logic switching circuit composed of Q10, Q9 and Q8 gates the IF amplifier output through the feedback amplifier formed by Q5, Q6 and Q7. When the EMC-25 analyzer is set to any band between 1 and 7, pin 11 of P3 goes to a low (0) level, as this is the "A" logic input. Switching transistor Q10 cuts off, allowing Q9 to conduct, which in turn drives Q8 into conduction. The amplifier composed of Q5, Q6 and Q7 then passes the detected video output to P3-2.

2.3.2 1.6 MHz IF AMPLIFIER (Figure 5.4). The IF input on J2-21 is applied to preset level control R9. The operation of the IF section including the detector is identical to the 175 KHz IF. The logic is slightly different because of the binary combinations involved. This IF is tuned on only for bands 8, 9 and 10. To select the IF, Q13 and Q12 must conduct. Q13 serves the same purpose here that Q9 does in the 175 KHz IF amplifier. In order for Q13 to conduct, both Q8 and Q9 must be cut off.

A logic switching circuit composed of Q10, Q11 and Q12 controls the operation of Q8 and Q9. With a high (1) level at P2-11, the "A" logic input, transistor Q9 is cut off. A low (0) level at P2-14, the "B" logic input, cuts off Q10. A low level at either P2-15 ("C" logic) or P2-16 ("D" logic) (or both) holds Q11 and Q12 off, since these transistors form an AND circuit for positive inputs. With Q10, Q11 and Q12 cut off, transistor Q8 is held cut off. Transistor Q13 will thus conduct, turning on Q12 and allowing the detected IF amplifier output to pass through the unity gain differential amplifier composed of Q5, Q6 and Q7 to output P2-2.

In case of band 11, transistors Q11 and Q12 are turned on simultaneously by a positive voltage on input pins 15 ("C" logic) and 16 ("D" logic). Q6 is turned on for band 12, 13, 14 and 15 ("B" logic). These inhibit conditions place the junction of R18 and R20 at ground. This places the base of Q8 slightly negative causing it to conduct. This in turn cuts off Q13, inhibiting this IF amplifier. During selection of bands 1-7, Q9 conducts, likewise cutting off Q13, inhibiting this IF amplifier. Therefore, the 1.6 MC IF AMP. will be turned on for bands 8, 9 and 10 only.

2.3.3 8.7 MHz IF AMPLIFIER (Figure 5.3). The IF input on J1-21 is applied to a preset level control R9. The operation of the IF section including the detector is identical to the 175 KHz IF. The logic is slightly different in that selection of this IF amplifier depends on the 175 KHz and the 1.6 MHz IF amplifiers being inhibited. The inputs on pins 12 and 13 originate from pin 12 of A1A2, the 175 KHz IF board, pin 13 of A1A3, and the 1.6 MC IF board respectively. The voltage at pin 12 will be negative when the 175 KHz IF is ON and 0 V when the IF is inhibited. Pin 13 receives the same information from the 1.6 MC IF. Whenever both are inhibited, these 0 V levels will be fed to the bases of Q10 and Q11, causing both to be cut off. Transistor Q9 will thus conduct, turning on Q8 and allowing the IF amplifier output to pass through the unity gain differential amplifier composed of Q5, Q6 and Q7 to P1-2.

The outputs of all three IF amplifiers (pin 2) are physically wired together. This is permitted since only one at a time is selected.

2.3.4 VIDEO AMPLIFIER (Figure 5.7). The input to the video amplifier is from one to two sources; from the common output point of the three IF amplifiers, or the amplitude modulated video from the EMC-25 depending on the position of the display switch. The video input is applied to the base of Q1-A. Voltage dividers R31/32 and R34/33 place a potential difference of approximately 150 MV between pins 6 and 7. The position control is connected between pins 6 and 7, the center tap being connected to the base of Q1-B by way of pin 4.

The amplitude variance of the video input to Q1-A causes the current through R2 to vary. This output from Q1-A is fed to the base of Q2-A. The output at the emitter of Q1-B places the base of Q2-B at a fixed potential determined by the setting of the position control. The current variation through R4 is caused by the signal at the base of Q2-A. The resulting voltage variation at the emitter of Q2-A is coupled through R6 and C2 to the emitter of Q2-B, effecting a drive to Q2-B base that is 180° out of phase with the video at the base of Q2-A. Amplified, out of phase video, is present at the collectors of Q2-A and Q2-B. These signals are fed to push-pull amplifiers Q3 and Q4. The amplified push-pull video signals at the collectors of Q3 and Q4 are fed to pins 21 and 15. These pins connect to the vertical deflection plates of the SPD-125. R14 is a factory adjustment that affects both the gain and the frequency response of the video amplifier. Capacitors C3 and C4 are factory selected to provide the correct amount of positive feedback across the push-pull output to increase high frequency response of the amplifier.

Potentiometer R22 picks off a selected amount of the video output and delivers it to pin 19 for use with an X-Y Recorder. R26 is adjusted for the proper DC offset level for this signal. A synchronizing signal for the model 74-14 time base is delivered to pin 20 through a network consisting of R24, R25 and C6.

2.3.5 SWEEP CONTROL (Figure 5.6). The function of the sweep control assembly is determined by the setting of the four-position function switch (A1S1) located on the front panel. A sawtooth sweep voltage originating in the model 74-14 time base plug-in unit of the scope is applied to pin 32 of J9001. This sweep voltage is presented to pin 4 of the sweep control (A4) as an input. The sawtooth voltage required to sweep the EMC-25 analyzer through the band always starts at 0 volt nominal at the low end of the band and goes to 1.3 volt nominal at the high end of the band.

2.3.5.1 FUNCTION SWITCH SETTINGS

2.3.5.1.1 SPECTRUM and LOCATOR Positions. The sawtooth sweep voltage from the time base

plug-in (74-14) is fed to pin 4 of the sweep control board A1A4. R36 (Spectrum High Freq. Adj.), which is part of a voltage divider consisting of R37, R36, and R35, adjusts the amplitude of the sawtooth voltage output. R32 (Spectrum Low Freq. Adj.), is part of a DC voltage divider consisting of R31, R32, and R33. Adjustment of R32 sets the DC reference level of the sawtooth voltage. The sawtooth output of this circuit is delivered to the EMC-25 tuning circuits by way of pin 2 of the sweep control board, the contacts of function switch S1-B and pin C of input connector J6. This sawtooth voltage will sweep tune the EMC-25 across an entire octave band.

2.3.5.1.2 SIGNATURE Position (Figure 2.2). In this setting of the function switch a portion of the sawtooth voltage from the Time Base Plug-In (74-14) is superimposed upon the tuning voltage of the EMC-25. The sweep voltage is fed in at pin 4 through R24 to junction of R23 and R19. The signature symmetry control (R26) adds a DC offset such that the sawtooth voltage varies equally positive and negative around the DC tuning voltage. This DC tuning voltage is obtained from a unity gain amplifier composed of Q7, Q8 and Q10. This amplifier, whose input is the EMC-25 tuning voltage, establishes a low impedance tuning voltage source for Q10-A and Q10-B. The signature range control (R19) varies the amplitude of the superimposed sawtooth voltage. When these controls are properly adjusted, the dispersion control (R2A) will vary the superimposed sawtooth from 0.15 V (nominal) to 0.0015 V (nominal) without changing the DC tuning voltage established by the EMC-25 tuning dial position. With the switch in this position, the tuning control on the EMC-25 determines the center point of the frequency sweep. The width of the frequency sweep from 10% of a band to 0.1% of a band is determined by the dispersion control setting on the PP-125.

2.3.5.1.3 VIDEO Position. In the video position the tuning voltage input from the EMC-25 bypasses the sweep control by way of S1B-4, and is fed directly from J6-A to J6-C as tuning E input to the EMC-25. In this position, the analyzer is not being scanned in frequency but is tuned to the frequency set by the frequency dial of the EMC-25. Video, therefore, is displayed as a function of time only.

2.3.5.1.4 Bright-Up Circuit (Figure 2.3). The sawtooth voltage from the model 74-14 Time Base Plug-In unit in the SPD-125 is fed to pin 4 of the sweep control board. From the arm of R36 it is fed through C1-R20 coupling to the base of transistor Q1-A, which is one input of a differential amplifier composed of Q1A, Q1B and Q2. The tuning voltage from the EMC-25 is fed to a low output impedance, unity gain amplifier composed of Q7, Q8 and Q10 and the output of this amplifier is then used as a reference for the second input to differential amplifier Q1 and Q2. The gain of this differential amplifier is controlled by the amount of feedback voltage from the voltage divider containing adjustments R2B (Disp. Control), R46 (Locator, Narrow Adj.) and R17 (Locator, Wide Adj.). The slope of the amplified sawtooth waveform at the collector of Q2 is varied by the previously mentioned adjustments. Since the feedback voltage divider is returned to the low impedance tuning voltage source, the average DC level at the collector of Q2 is varied by the tuning voltage, and therefore by the position of the EMC-25 tuning dial. Either

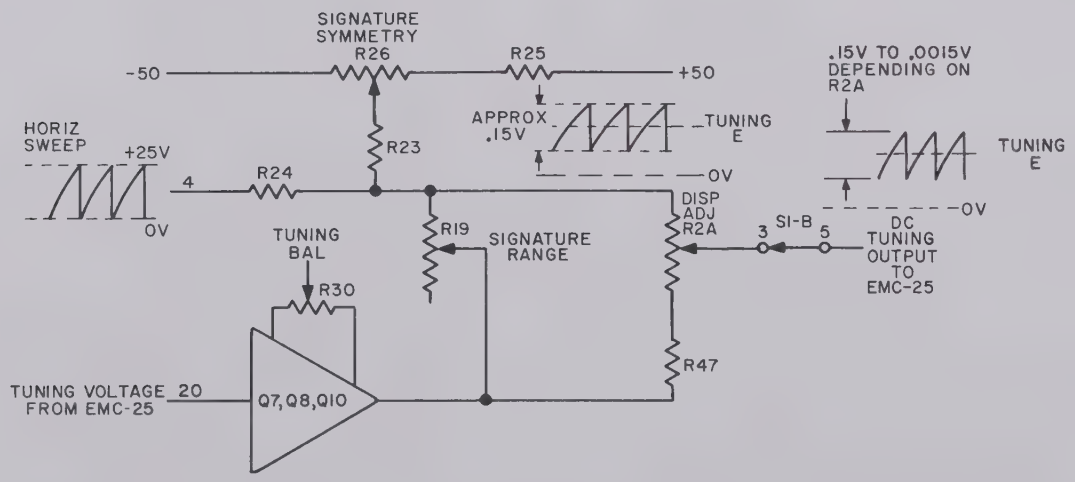


Figure 2.2 Function Switch Setting, Signature

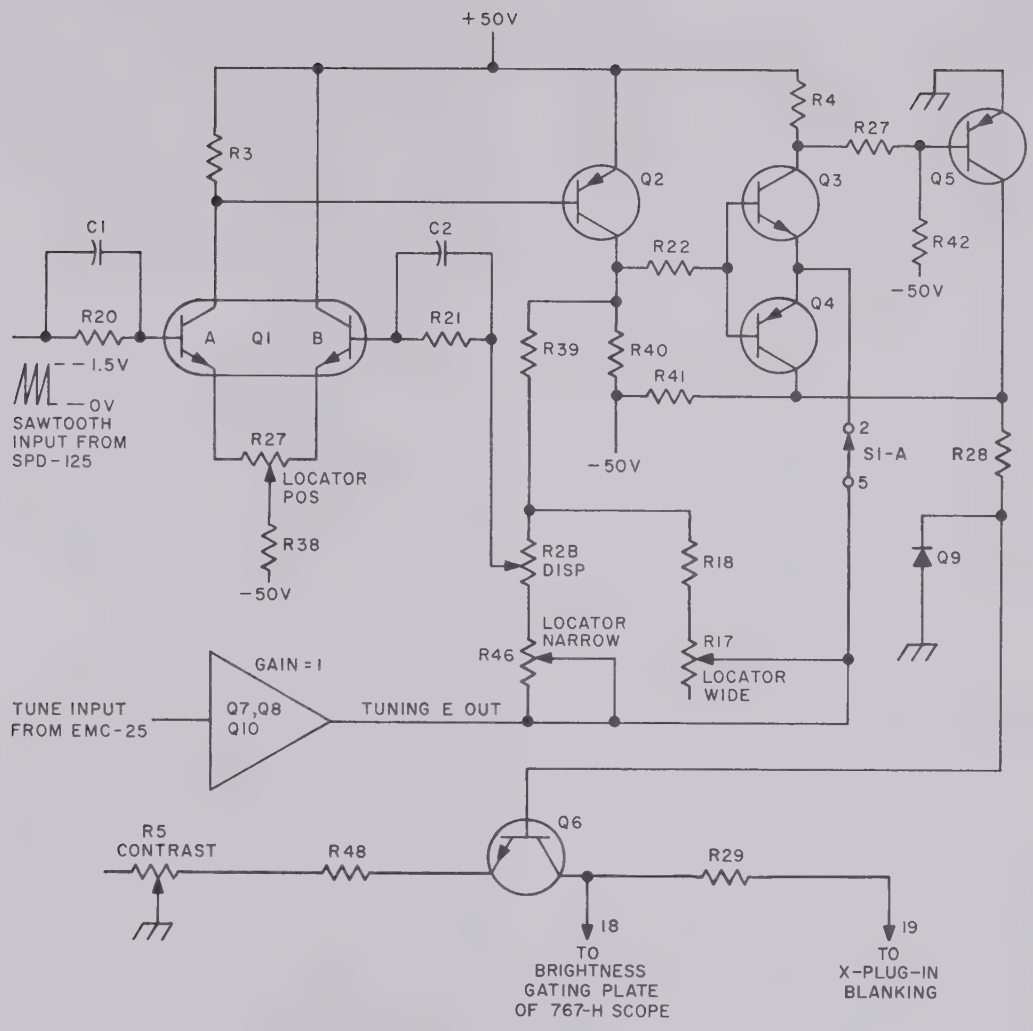


Figure 2.3 Bright-Up Circuit, Simplified Diagram

Q3 or Q4 will conduct when the potential at the collector of Q2 is either positive or negative respectively as compared to the tuning voltage output from the operational amplifier. Whenever either Q3 or Q4 conducts, the base of Q6 will be driven positive causing it to conduct. The resulting drop across R29 will cause the potential on the brightness gating plate in the scope to decrease. As a result the trace presented will be dimmed.

The amount of conduction of Q6 depends on setting of A1R5 (CONTRAST). Q3 or Q4 must have a forward bias of 0.4 volt or more before each will conduct. Because of this neither Q3 nor Q4 conducts when the voltage at the collector of Q2 varies between -0.4 V and +0.4 V with respect to the tuning voltage. The voltage at the collector of Q2 varies from a negative to a positive value during the period of each sweep. During the interval of the sweep when Q3 and Q4 are cut off, the voltage on the brightness gating plate in the scope will increase to the value on the collector of Q6 (X-plug-in blanking voltage). This will cause that portion of the trace to brighten. The point on the sawtooth voltage where Q3 and Q4 are both cut off is determined by the DC tuning voltage. Therefore as the tuning dial on the EMC-25 is varied, the tuning voltage will vary, causing the brightened portion of the sweep to move along the trace. The amount of time that both Q3 and Q4 are cut off is determined by the slope of the sawtooth voltage at the collector of Q2. When the arm of R2B (Disp.) is moved closer to R46 (CCW), the gain of the differential amplifier is increased causing the slope of the sawtooth to increase. Q3 and Q4 cut-off time decreases causing the intensified portion of the trace to narrow. Adjustment of R2B in the opposite direction will reverse conditions, causing the intensified portion of the trace to widen.

R46 (Locator, Narrow Adj.) affects the maximum gain of the differential amplifier, setting

the minimum feedback level. This control is used to adjust the narrowest intensified portion of the sweep. R27 (Locator, Wide Adj.) affects the minimum gain of the differential amplifier, setting the maximum feedback level. This control is used to adjust the widest intensified portion of the sweep. R27 (Locator Position), connected between the emitters of Q1, adjusts the DC balance between Q1-A and Q1-B. It is therefore used to adjust the intensified portion of the sweep to the desired position for a given tuning voltage.

The emitter circuit of Q3 and Q4 is returned to the tuning voltage reference through contacts of S1-A, the sweep control function switch. This connection is made only in the LOCATOR position of the function switch. In other positions of the function switch the emitter circuit of Q3 and Q4 is opened and the bright-up circuit does not function.

SECTION III
OPERATING INSTRUCTIONS

3.1 GENERAL

3.1.1 This section provides instructions for operation of the Spectrum Display PP-125. This unit is a special purpose plug-in, used with the Model 767-H Oscilloscope and the Model 74-14 Time Base plug-in. Combined, these three units comprise the SPD-125 Spectrum Display Module. Instructions are also included for pre-operating calibration and checkout.

3.2 UNPACKING

3.2.1 Remove the instrument carefully from the shipping carton and examine thoroughly for shipping damage. If there is any damage, replace the instrument in the shipping carton and immediately inform the manufacturer and the shipping company of the nature of the damage, the serial number of the instrument, the delivery date, and the invoice number.

3.2.2 Check contents of carton against shipping list to be sure all items ordered are present. Notify the manufacturer immediately of any missing items.

3.3 ELECTRONIC SHIPPING DAMAGE

3.3.1 Before leaving the factory, this instrument was subjected to a complete operational check. However, it is possible that electronic damage may have occurred in transit. It is desirable, therefore, to check the operation of the instrument as soon as possible after unpackaging.

To do so, check the overall operation of the instrument as outlined in paragraph 3.7. If the instrument does not perform using the referenced procedure, inform the manufacturer giving the basic information required in paragraph 3.2.1.

3.4 INSTALLATION

The Spectrum Display PP-125 is designed to operate as a Y-plug-in for the Fairchild 767-H Scope. To install this instrument into the SPD-125 scope, carefully insert into the cavity provided for the Y input plug-in unit. Care must be taken to insure proper mating between J9001 and P9001. Firmly press unit in place until the front panel is flush. Tighten the knurled knob at the bottom center clockwise until tight.

3.4.1 ELECTRICAL INSTALLATION

3.4.1.1 Connect the BNC cable, Part No. 4647-2, provided between the AM VIDEO connection on the front panel of the EMC-25 receiver and the AM VIDEO connection on the front panel of the PP-125 scope plug-in.

3.4.1.2 Connect the BNC cable, Part No. 4648-2, provided between the POST IF output connector on the rear of the EMC-25 and the POST IF connector on the front panel of the PP-125.

3.4.1.3 Connect the multi-conductor cable (4657) provided between the REMOTE connector on the EMC-25 front panel and the multi-pin connector on the front panel of the PP-125. The remote cable is secured to its respective connectors with two thumb screws which must be evenly tightened after alignment of the mated connectors is completed.

CAUTION

The EMC-25 should be turned OFF while making the remote cable connections.

3.4.1.4 If the PP-125 Spectrum Display is to be used with a 767-H oscilloscope which has not been mated to it at the factory, modify the existing scope circuitry as shown in Figure 3.1.

3.4.1.5 Using the power cords provided, connect both the EMC-25 and the SPD-125 to an AC power source per their instruction manuals.

3.4.1.6 If the EMC-25 and SPD-125 have not been previously checked out together, the calibration adjustments outlined in Section 4.4 should be performed before they are placed in operation.

3.4.1.7 The EMC-25 Instruction Manual and the sections of this manual pertaining to the 767-H scope frame and 74-14 Time Base give mechanical and electrical installation instructions for the other individual units of the system.

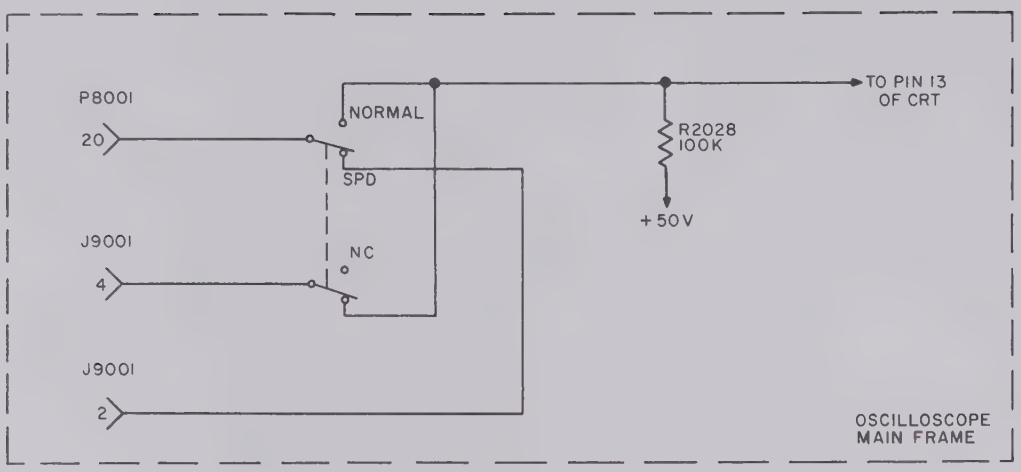


Figure 3.1 Oscilloscope Main Frame Modification - Switch in SPD Position

3.5 CONTROL FUNCTIONS (Figure 3.2)

3.5.1 SWEEP FUNCTION SWITCH

3.5.1.1 SPECTRUM POSITION. In this position the correctly adjusted CSR-200 system will display a swept frequency spectrum on the scope which covers an entire octave tuning band of the EMC-25 receiver.

3.5.1.2 LOCATOR POSITION. With the function switch in this position the display is the same as in the spectrum position except that a brightened-up section of the scope trace indicates the portion of the band which will be displayed when the function switch is advanced to SIGNATURE. The position of the brightened-up section of the trace is varied by the EMC-25 tuning control and the width of this brightened-up section is varied by the DISPERSION control of the PP-125.

3.5.1.3 SIGNATURE POSITION. With the function switch in this position, a small portion of an EMC-25 frequency band is displayed as a swept frequency spectrum. The frequency range swept can be varied from 10% to 0.1% of an EMC-25 octave band by variation of the DISPERSION control. The center frequency of this expanded sweep is determined by the position of the EMC-25 tuning control, and may be read on the EMC-25 tuning dial.

3.5.1.4 VIDEO POSITION. With the switch in this position, the frequency is not swept. The scope display will consist of an AM detected time-based display of any signal tuned in on the EMC-25.

3.5.2 CONTRAST CONTROL. This is a screwdriver adjustment located on the front panel of the PP-125. With the function switch in locator position, it controls the difference in brightness level between the scope trace and the brightened locator indicator appearing on the trace. This adjustment has no effect except in the locator position of the function switch.

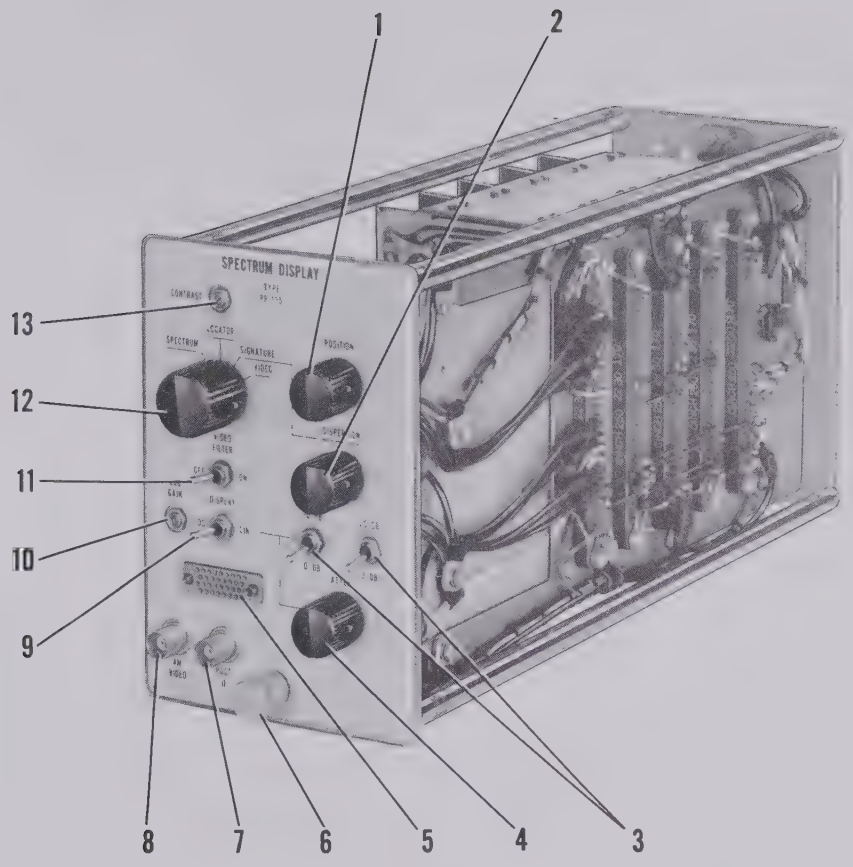
3.5.3 POSITION CONTROL. This control provides vertical positioning of the scope trace.

3.5.4 DISPERSION CONTROL. This front panel control varies the portion of the EMC-25 band swept from 10% to 0.1% of the frequency band with the function switch in SIGNATURE position. In the LOCATOR position, this portion of the full band sweep is illuminated by a brightened-up trace section. The width of this brightened section is varied by the position of the DISPERSION control to indicate the band-segment to be swept when the function switch is in the SIGNATURE position.

3.5.5 VIDEO FILTER. In the ON position of this switch, a low-pass filter is inserted to decrease noise and interference on the scope, allowing low level responses to be viewed.

3.5.6 DISPLAY (LOG/LIN)

3.5.6.1 In the LOG position, a logarithmically compressed DC coupled display of the video information is presented on the scope. This allows for a full 60 DB dynamic range to be presented allowing simultaneous observation of both low and high amplitude signals. The right-hand markings of the scope graticule are the calibration indicators for this display and correspond to the EMC-25 indicator meter markings. The scope display is therefore an instantaneous dynamic presentation of the static EMC-25 meter reading. When using the swept frequency functions, the amplitude of all responses presented



1. POSITION (A1R3)
2. DISPERSION (A1R2)
3. ATTENUATORS (A1S2, A1S3)
4. ATTEN (A1R17)
5. INPUT CONNECTOR (A1J6)
6. Lock Knob
7. POST IF (A1J7)
8. AM VIDEO (A1J8)
9. DISPLAY (A1S4)
10. LOG GAIN (A1R18)
11. VIDEO FILTER (A1S5)
12. FUNCTION (A1S1)
13. CONTRAST (A1R5)

Figure 3.2 Spectrum Display PP-125, Front Panel Controls and Adjustments

on the scope may be determined in DB/uV by the graticule markings.

3.5.6.2 In the LIN position of the DISPLAY switch the scope presentation is linear in respect to amplitude permitting observation of responses in their true linear relationship, without distortion or compression. To provide the same 60 DB range in this display as in LOG, two 20 DB attenuator switches and a variable attenuator control are provided on the front panel. The left-hand markings of the scope graticule are used in this display position, and calibration is in percent.

3.5.7 LOG GAIN CONTROL. This control is a screwdriver adjustment on the front panel of the PP-125 used to calibrate the LOG display of the scope to the EMC-25 meter reading.

3.5.8 0 - 20 DB SWITCHES. These switches provide 0, 20, and 40 DB attenuation of the signal in the LIN display mode. Through their use, any on-scale response in the LOG display mode may be presented as a linear display. With both attenuators switched to 20 DB, a +20 DB/uV response in the LOG display mode can be adjusted to produce a 100% response in the LIN display mode by using the variable attenuator control. Under these conditions, a -20 DB/uV response in the LOG display mode would not be visible in the LIN mode. However, switching the attenuator switches to give 0 DB attenuation would produce 100% deflection.

3.5.9 ATTENUATOR CONTROL. This control is used as a vernier control between the 20 DB steps mentioned in 3.5.8 above.

3.5.10 REMOTE CONNECTOR (J6). All the remote bandswitching and remote tuning information for the system's operation passes through this cable, connected between the EMC-25 and this input to the PP-125.

3.5.11 AM VIDEO (J8). The DC coupled, logarithmically detected output of the EMC-25 is fed into this input through a coaxial cable. In the LOG display mode, this signal (after amplification) is used for the vertical deflection of the scope.

3.5.12 POST IF (J7). This input couples the IF output of the EMC-25 to the PP-125 by means of a coaxial cable. In the LIN display mode, this IF signal is amplified, linearly detected and used for the vertical deflection.

3.5.13 SPD-NORMAL SWITCH. This switch is located in the main frame of the SPD-125. It is accessible by removing the bottom cover of the SPD and is located on a plate underneath the CRT. Its function is to allow intensity modulation of the CRT by the PP-125 plug-in. It must be in the SPD position when used in conjunction with the PP-125, but must be in normal position when using conventional Y plug-ins. If the scope frame has not been furnished specifically for use with the PP-125, this switch must be added (see Figure 3.1). Installation kits are available from Electro-Metrics Corp. The circuit changes affected by the switch are as shown in Figure 3.1.

3.6 OPERATIONAL PRECAUTIONS

3.6.1 CONNECTORS. Normal operation can be achieved only after Spectrum Display PP-125 has been placed in the Y input cavity of the SPD-125 and POST IF (J7), AM VIDEO (J8) and INPUT CONNECTOR (J6) have been properly connected to cables leading to corresponding connectors on the Interference Analyzer, Model EMC-25. (See Figure 4.2.)

3.6.2 ADJUSTMENTS. Several adjustments (potentiometers) exist on the sweep control board (A1A4) and the video amplifier (A1A5), and one input level control on each IF amplifier (A1A1-A1A3). If this instrument is shipped as a part of Spectrum Analyzer CSR-200, these adjustments will have been preset at the factory and further adjustments will not be necessary. In the event this instrument is purchased separately to supplement already existing equipment, or is to be used in place of another PP-125 in a different CSR-200 system, the adjustment of these potentiometers must be performed. Reference should be made to the Service and Maintenance Section (4.4) for specific procedures given to accomplish this.

3.7 PRE-OPERATIONAL CALIBRATIONS

This section details these adjustments and control settings which should be checked prior to making any actual measurements.

3.7.1 EMC-25 CALIBRATION. Set the function switch of the PP-125 to VIDEO, and amplitude calibrate the EMC-25 Analyzer as described in Section 3.7.2 of the EMC-25 Instruction Manual. This initial calibration is done in the center of the initial band of interest. As the gain of the EMC-25 varies from band to band, and varies somewhat across a band, the calibration procedure should be repeated with the EMC-25 tuned to a received signal before the exact amplitude of this signal can be established.

3.7.2 DETECTOR FUNCTION SETTING. The EMC-25 detector function switch is normally set in the PEAK position during the operation of the CSR-200 system. This allows the amplitude of a single response, or the amplitude of the highest response during a frequency sweep to be read directly on the EMC-25 meter. The setting of this switch does not affect the scope presentation.

3.7.3 INITIAL CONTROL SETTINGS. The control settings listed in Table 3-1 are intended as a starting reference point only. In the following paragraphs these settings are altered as different display functions are described.

TABLE 3-1

INITIAL CONTROL SETTINGS

Control	Setting
EMC-25	
ATTENUATOR	CAL
BANDWIDTH	WIDE
DETECTOR FUNCTION	PEAK
Tuning Mode	MANUAL
TUNING AID	OFF
DUMP	OFF
PP-125	
Function	SPECTRUM
VIDEO FILTER	OFF
DISPLAY	LOG
DISPERSION	Fully Clockwise
POSITION	As Noted
Attenuator Switches	Both 20 DB
Attenuator Control	Fully Clockwise
SPD-125	
SWEEP SPEED	5 ms/cm
Triggering Source	Line
Other scope controls adjusted to provide a bright, sharp trace on the scope.	

3.7.4 SWEEP SPEED CONSIDERATIONS. The maximum usable horizontal sweep speed is limited by the relationship between the IF bandwidth of the EMC-25, and the rate of change of frequency. The approximate point at which the response amplitude will be decreased by 3 DB due to the sweep speed is given by the expression:

$$\text{Sweep speed in cm/sec} = \frac{\Delta F}{(BW)^2 \times 10}$$

where ΔF is the band of frequencies being swept, and BW is the IF bandwidth (3 DB) of the receiver.

It can be seen from this relationship that the highest usable sweep speed will vary greatly with EMC-25 band and bandwidth settings, as well as the settings of the PP-125 function and dispersion controls. To determine if the sweep speed used is too fast, decrease the sweep speed and note if the response amplitude changes. The maximum usable sweep speed is the maximum speed at which no decrease in amplitude response occurs.

A second limitation to the sweep speed is the time constant of the EMC-25 tuning circuit. At sweep speeds above 5 ms/cm a shift may be noted in the horizontal position of responses viewed on the scope. This shift will decrease the accuracy of frequency determination.

3.7.5 LOG GAIN CALIBRATION. Before measurements are made the amplitude calibration of the PP-125 should be checked as follows.

3.7.5.1 Turn the function switch of the PP-125 to VIDEO. Inject a CW signal into the input of the EMC-25. Adjust the amplitude of the input signal until a full scale (+20 DB) reading is obtained on the EMC-25 meter.

3.7.5.2 Now set the PP-125 function switch to SPECTRUM. Disconnect the cable connected to the PP-125 AM VIDEO input jack and adjust the POSITION control of the PP-125 until the scope trace is positioned at the bottom line of the scope graticule. Then reconnect the AM VIDEO cable to the PP-125.

3.7.5.3 The top of the signal induced response now present on the scope should coincide with the top line (+20 DB) of the scope graticule. The sweep speed should be reduced to check if too high a speed is limiting the response amplitude. (See Section 3.7.3.) If the top of the response does not coincide with the top line of the graticule under the above conditions, adjust the LOG GAIN control, a screwdriver adjustment on the front panel of the PP-125, until this condition exists.

3.8 OPERATING PROCEDURE

Following are brief descriptions of the displays which can be presented, and the interpretation of these displays.

3.8.1 TRACE POSITIONING (LOG DISPLAY). During operation, the setting of the POSITION control can most easily be accomplished by obtaining a full scale signal induced response on the EMC-25 meter, and adjusting the POSITION control until the top of the scope response coincides with the top line of the scope graticule. The noise level in the LOG display mode will raise the base line of the sweep so that this baseline will not necessarily correspond to the bottom line of the scope graticule. In the absence of a signal, an approximate positioning adjustment may be made by turning the display switch of the PP-125 to LIN, and adjusting the baseline position until it corresponds to the bottom line of the graticule. To be sure noise is not affecting this adjustment both ATTENUATOR switches should be in their 20 DB position.

3.8.2 SPECTRUM SWEEP (LOG DISPLAY). In the spectrum display position the full octave range of an EMC-25 band is frequency swept. The peak amplitude of any responses are indicated by their height, and frequency of the responses is indicated by their horizontal position.

3.8.2.1 AMPLITUDE DETERMINATION

3.8.2.1.1 The amplitude in DB/uV of a response on the scope may be determined by algebraically adding the attenuator setting of the EMC-25 to the amplitude of the scope response, as determined by the markings on the right-hand side of the scope graticule. For accurate amplitude determination the EMC-25 must first be calibrated at the response frequency. The sweep speed limitations as noted in Section 3.7.4 should be observed. The display presented in the scope is logarithmically compressed so that a full 60 DB dynamic range is presented. This range corresponds to the EMC-25 meter display.

3.8.3 LOCATOR DISPLAY. The display observed in the LOCATOR position of the PP-125 function switch is the same as in the SPECTRUM position, except that a small segment of the sweep is brightened. The position of the brightened trace section is varied by the EMC-25 tuning dial, and the width of this brightened section is varied by the DISPERSION control. This brightened sweep section illuminates the band of frequencies to be swept in the SIGNATURE position of the PP-125 function switch.

The contrast between the brightened-up section and the rest of the trace may be adjusted by the CONTRAST control, a screwdriver adjustment on the front panel of the PP-125. If the INTENSITY control is changed, a readjustment of the CONTRAST control may be required.

3.8.3.1 FREQUENCY DETERMINATION. In the LOCATOR position of the PP-125 function switch, the frequency of a received response may be determined as follows.

3.8.3.1.1 Turn the DISPERSION control fully clockwise. A brightened dot will appear on the scope trace. This dot indicates the frequency on the scope display to which the EMC-25 TUNING pointer is set. By turning the EMC-25 TUNING control this dot may be moved across the trace until it is positioned at the peak of a signal response spike. The frequency of this response may now be read from the EMC-25 TUNING dial.

3.8.4 SIGNATURE SWEEP (LOG DISPLAY)

3.8.4.1 With the PP-125 function switch still in LOCATOR, turn the DISPERSION control fully counterclockwise. The illuminated section of the scope trace will now be about 1 cm long. Adjust the EMC-25 TUNING control until a signal response is in the center of the brightened-up trace segment. Next turn the function switch to its SIGNATURE position. The display on the scope face is now expanded so that the frequency sweep covers only that band of frequencies previously illuminated by the locator. The frequency at the center of the trace is indicated by the EMC-25 TUNING dial. The peak amplitude of a response indicates the input signal amplitude. The shape of the response is determined by the modulation characteristics of the signal.

3.8.4.2 DISPERSION CONTROL. Turning the DISPERSION control clockwise causes the scope display to be expanded further. This control varies the band of frequencies swept from 10% of an EMC-25 band to 0.1% of a band.

3.8.5 SIGNATURE SWEEP (LINEAR DISPLAY)

3.8.5.1 In the LIN position of the display switch, signal amplitudes are presented linearly. The two 0-20 DB ATTENUATOR switches, and the variable ATTENUATOR control are used to allow any amplitude of received signal to be presented as a linear display. If a received signal produces a response of approximately +20 DB on the scope graticule in the LOG display mode, for a LIN display, both ATTENUATOR switches should be in their 20 DB positions. The variable ATTENUATOR control may be adjusted so that the response amplitude is 100% (left hand graticule markings). The amplitudes of signal side bands, signal modulation, and nearby signals now may be determined in percentage of the received signal carrier amplitude. For signal responses of lower amplitude one or both of the 0-20 DB ATTENUATOR switches may have to be switched to 0 DB in order to adjust the response amplitude for a 100% display. A 0 DB LOG display amplitude will require one of the ATTENUATOR switches to be 0 DB, while a -20 DB LOG display amplitude will require both ATTENUATOR switches to be in their 0 DB positions. The positions of the ATTENUATOR controls has no effect on the LOG display.

3.8.5.2 INPUT SIGNAL MODULATION. The amplitude frequency type, and character of modulation of a received signal may be determined by the scope display.

3.8.5.3 NARROW BANDWIDTH OPERATION. After acquiring a signal as in Section 3.8.5.1, turn the BANDWIDTH selector on the EMC-25 to NARROW. The signal induced response on the scope will narrow considerably as the IF bandwidth has narrowed by about 1/10. If the amplitude of the trace decreases, the sweep speed should be decreased until the normal amplitude is restored. The maximum usable sweep speed for NARROW band operation is about 1/100 that of WIDE band. (Refer to Section 3.7.4.) Because of this, very slow sweep speeds must be used in the SPECTRUM and LOCATOR sweep functions. In SIGNATURE, however, reasonably high sweep speeds may be used. Narrow bandwidth operation is used to separate two closely spaced responses, to investigate the modulation spectrum of a received signal, or, because of the improved sensitivity, to investigate weak signals.

3.8.6 SPECTRUM AND LOCATOR SWEEPS (LINEAR DISPLAY)

3.8.6.1 In the SPECTRUM or LOCATOR positions of the sweep function switch, responses across the frequency spectrum may be compared as to their linear amplitude relationship to each other.

3.8.7 TRACE POSITIONING (LINEAR DISPLAY)

3.8.7.1 In the LINEAR DISPLAY mode, trace positioning is accomplished in the spectrum sweep switch position by adjusting the baseline of the scope trace to coincide with the bottom line of the scope graticule. Both ATTENUATOR switches of the PP-125 should be in their 20 DB position to reduce baseline noise during this adjustment.

3.8.8 WIDEBAND CALIBRATION. The Impulse Generator of the EMC-25 may be used to dynamically amplitude calibrate the scope display. The locus of the peak impulse level across the scope defines a constant impulse sensitivity level of the EMC-25 across the spectrum being swept. As the impulse bandwidth of the EMC-25 is typically within 2 DB across a band, as shown by the calibration chart, this locus is also representative of the approximate CW sensitivity. A correction factor may be obtained from the relative impulse amplitudes across the scope display.

3.8.8.1 To determine this correction factor at various points in the frequency band, first calibrate the EMC-25 at a center frequency of the band of interest. Set the system controls as noted in Table 3-1, except that the Sweep Function switch should be set in its LOCATOR position. Now hold in the SHUNT CAL button on the EMC-25. A series of narrow pulses will appear across the scope display. The INTENSITY control may have to be adjusted to improve the visibility of the pulses. The peak level of the pulses occurring in the center of the brightened-up section of the sweep should be noted as their amplitude represents the calibrated condition of the EMC-25. Any variation of the amplitude of these pulses across the scope is indicative of the manner in which the EMC-25 gain varies across the band. Tune the EMC-25 to a new frequency setting and once more note the amplitude of the pulses illuminated by the locator. The difference between this amplitude and the pulse amplitude noted at the calibration frequency is the correction factor. This should be algebraically subtracted from the level of a response at the new frequency setting to determine its approximate amplitude.

3.8.9 VIDEO RESPONSE FUNCTION

3.8.9.1 In the video position of the sweep function switch the EMC-25 is fix-tuned at the frequency indicated by the EMC-25 TUNING dial. The scope presentation is a time domain display of the amplitude characteristics of any signal tuned in on the EMC-25. The modulation of such a signal can be quantitively investigated. The scope pattern is synchronized as described in the section of the instruction manual covering the Model 74-14 Horizontal Sweep Plug-In.

SECTION IV
SERVICE AND MAINTENANCE

4.1 GENERAL

4.1.1 This section includes material necessary for the maintenance and repair of the Spectrum Display PP-125. Repair should be attempted only by individuals familiar with the theory of operation of the PP-125. All maintenance will be performed using the PP-125 installed in the 767-H Main Frame and connected to an EMC-25.

CAUTION

Readjustment of almost any internal control can invalidate calibrations performed that make this instrument compatible with a given Interference Analyzer, EMC-25 and the SPD-125 Spectrum Display Module. All plug-in cards, A1A1 through A1A5, contain one or more adjustments.

4.2 REPLACEMENT OF ASSEMBLIES

4.2.1 Replacement of assemblies can be accomplished only after the Spectrum Display PP-125 has been removed from the 767-H Main Frame. To remove the PP-125 from the 767-H unscrew the knurled knob counterclockwise at the bottom center of the unit. After the knob is completely loose, pull the PP-125 straight out until it is completely detached from the 767-H.

4.2.2 Individual assemblies (A1A1 through A1A5) may now be removed from the PP-125 main chassis in a conventional fashion. Figure 4.1 shows the physical location of all plug-in assemblies. Table 4-1 lists the plug-in assembly by name, nomenclature and location.

4.3 PERIODIC SERVICE

4.3.1 This unit is a stable instrument that will provide many hours of trouble-free operation. Since this instrument is a plug-in unit for the 767-H Scope, it should be given the same periodic check. It is suggested that this instrument be calibrated after each 500 hours of operation or every six months if used intermittently. Also the calibration should always be checked and adjusted after the repair and/or replacement of any component part on one of the individual assemblies or main chassis. Complete adjustments and calibration procedures are given in this section.

NOTE

The regulated power supplies on the main frame of the Scope should always be checked before calibration of this instrument.

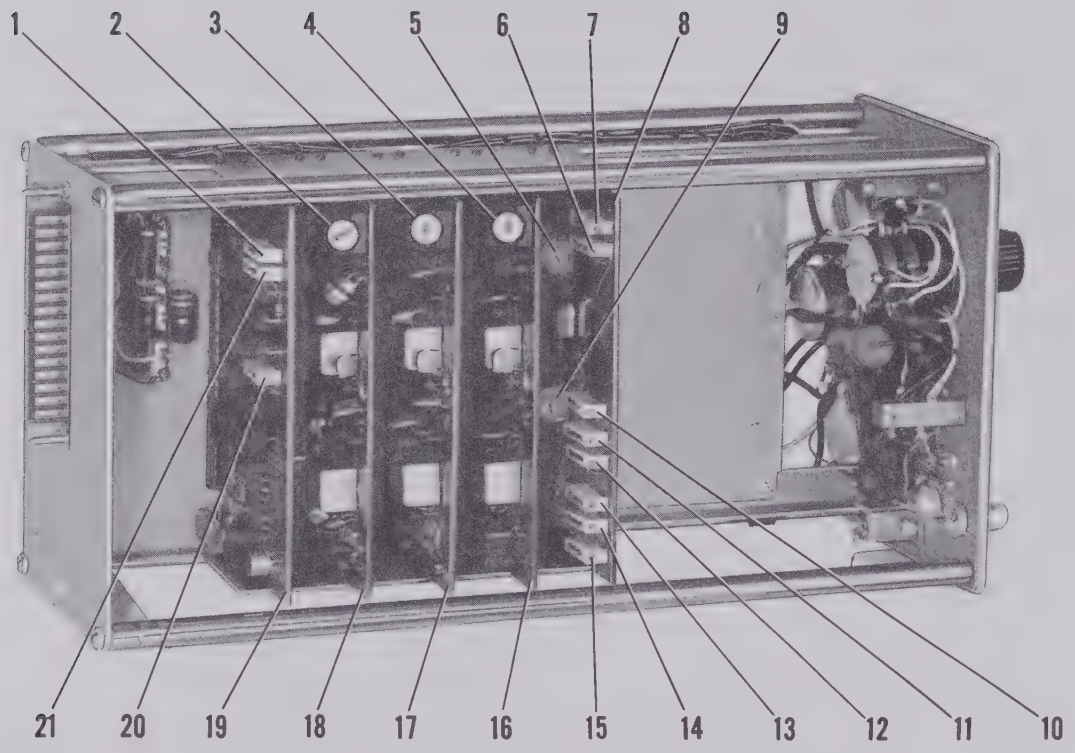
4.4 TEST EQUIPMENT REQUIRED FOR CALIBRATION AND ADJUSTMENTS

4.4.1 Adjustments outlined in Section 4.5 are based on test procedures followed at the factory. Table 4-2 lists the test equipment required to

TABLE 4-1

REPLACEABLE ASSEMBLIES

NAME	NOMENCLATURE	LOCATION
8.7 MHz IF Amplifier	A1A1	Figure 4.1
1.6 MHz IF Amplifier	A1A2	Figure 4.1
175 KHz IF Amplifier	A1A3	Figure 4.1
Sweep Control	A1A4	Figure 4.1
Video Amplifier	A1A5	Figure 4.1



1. R22, Y Output Gain Control
2. R9, 8.7 MHz IF Gain Control
3. R9, 1.6 MHz IF Gain Control
4. R9, 175 KHz IF Gain Control
5. R30, Tuning Balance Control
6. R17, Locator Width Control (Wide)
7. R46, Locator Width Control (Narrow)
8. Sweep Control Board A1A4
9. R27, Locator Position Control
10. R9, X Output Zero Adjust Control
11. R1, X Output Gain Control
12. R19, Signature Range Control
13. R26, Signature Symmetry Control
14. R32, Spectrum LF Adjust Control
15. R36, Spectrum HF Adjust Control
16. 175 KHz IF Amplifier Board A1A3
17. 1.6 MHz IF Amplifier Board A1A2
18. 8.7 MHz IF Amplifier Board A1A1
19. Video Amplifier Board A1
20. R14, Video Gain Control (Factory Adj.)
21. R26, Y Output Zero Adjust Control

Figure 4.1 Replaceable Assemblies with Calibration Adjustments

complete the adjustments and calibrations for operation with the scope.

4.5 SPECTRUM DISPLAY PP-125 CALIBRATION AND ADJUSTMENTS

4.5.1 SPECTRUM DISPLAY PP-125 TEST SETUP (Figure 4.2). Figure 4.2 shows the interconnections between the scope main frame, the Interference Analyzer EMC-25, Signal Generator and the Spectrum Display PP-125. Table 4-3 lists all preliminary front panel control settings necessary prior to actual calibration and adjustments of the PP-125. Subsequent paragraphs deal categorically with adjustments related to complete calibration of the PP-125 before it can be used as a Y-plug-in for the 767-H Scope. If the PP-125 has been received as part of a CSR-200 these adjustments have been performed at the factory.

4.5.2 SPECTRUM DISPLAY PP-125 SWEEP, CALIBRATION AND ADJUSTMENTS. In the following procedures be certain the horizontal sweep speed is not set too fast. If a change of sweep speed causes a change in the amplitude or shape of the trace presented, the sweep speed should be decreased until no further response change is noted. The maximum permissible sweep speed will vary depending on PP-125 function setting and EMC-25 band and frequency settings.

TABLE 4-2

TEST EQUIPMENT REQUIRED

EQUIPMENT	DESCRIPTION
Signal Generator (14 KHz - 10 MHz)	Hewlett-Packard, HP651 or equivalent
Signal Generator (10 MHz - 500 MHz)	Hewlett-Packard, HP608 or equivalent
Oscilloscope	Fairchild, Main Frame, 767-H with Time Base plug-in unit, type 74-13A and amplifier plug-in 76-03 or equivalent
Voltmeter	Simpson 260 or equivalent
Extender Cable	1 multiwire cable to allow Spectrum Display PP-125 to be connected to external 767-H scope, Fairchild - 4294 (optional)

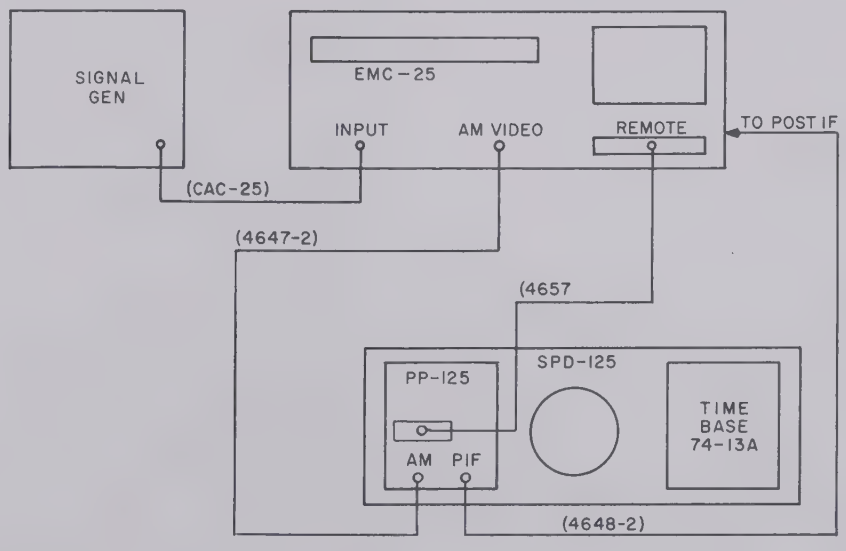


Figure 4.2 Spectrum Display PP-125, Test Setup

TABLE 4-3

PRELIMINARY FRONT PANEL ADJUSTMENTS

EMC-25		PP-125	
CONTROL	SETTING	CONTROL	SETTING
ATTENUATOR	CAL	Function Switch	SPECTRUM
BANDWIDTH	WIDE	VIDEO FILTER	OFF
Bandswitch	60-120 KHz	Display Switch	LOG
Frequency	80 KHz	DISPERSION	As noted in procedures
Detector Function	PEAK	POSITION	As noted in procedures
TUNING AID	OFF	0 - 20 DB Attenuator Switches	Both - 20 DB
Tuning Mode	Manual	Attenuator Control	Fully CW
DUMP	Off		

4.5.2.1 LOG GAIN ADJUSTMENTS

4.5.2.1.1 Set the function switch to VIDEO.

4.5.2.1.2 Disconnect the cable connected to the AM VIDEO jack of the PP-125. Adjust the POSITION control until the trace is superimposed on the bottom line of the scope graticule ($-\infty$). Reconnect the AM VIDEO cable.

4.5.2.1.3 Insert an 80 KHz, 100 uV signal into the EMC-25 RF input. Adjust the TUNING and CAL controls for full scale (+20 DB) indication on the EMC-25 meter.

4.5.2.1.4 Adjust the LOG gain control (A1R18) until the trace coincides with the top line of the scope graticule (+20 DB). This is a screwdriver adjustment on the front panel of the PP-125.

4.5.2.2 TUNING ADJUSTMENT

4.5.2.2.1 With a full-scale reading (+20 DB) on the EMC-25 meter, set the FUNCTION switch on the PP-125 to SIGNATURE. Rotate the DISPERSION control fully CCW.

4.5.2.2.2 Adjust the tuning balance control (R30) located on the Sweep Control Assembly (A1A4) such that the top of the trace occurs at the vertical center line of the scope.

4.5.2.3 SPECTRUM SWEEP RANGE ADJUSTMENTS

4.5.2.3.1 Set the FUNCTION switch on the PP-125 to VIDEO. Set the frequency of the EMC-25 to the extreme left against the mechanical stop (lowest frequency). Adjust the signal generator frequency for maximum deflection of the trace.

4.5.2.3.2 Set the FUNCTION switch on the PP-125 to SPECTRUM. Turn the SPECTRUM LF ADJ (R32) on the sweep control assembly (A1A4) until the marker generated by the signal generator is located at the extreme left end of the trace. (The left half of the response will not appear since sweep starts at point of maximum amplitude.)

4.5.2.3.3 Set the FUNCTION switch on the PP-125 to VIDEO. Set the FREQUENCY of the EMC-25 to the extreme right against the mechanical stop (highest frequency). Adjust the signal generator frequency for maximum deflection of the trace.

4.5.2.3.4 Reset the FUNCTION switch on the PP-125 to SPECTRUM. Turn the SPECTRUM HF ADJ (R36) on the sweep control assembly (A1A4) until the marker generated by the signal generator is located at the extreme right end of the trace.

4.5.2.3.5 Recheck the lower and upper frequency extremes, readjusting as described in 4.5.2.3.2 and 4.5.2.3.4.

4.5.2.4 LOCATOR ADJUSTMENTS

4.5.2.4.1 Set the FUNCTION switch on the PP-125 to LOCATOR. Turn the DISPERSION control fully CW. Set the FREQUENCY of the EMC-25 to 80 KHz. A short portion of the scope

trace near the center will be brighter than the rest of the trace.

4.5.2.4.2 Adjust the contrast control (A1R5) on the front panel of the PP-125 until the dimmer portion of the trace is clearly visible. (A1R5 is a screwdriver adjustment.) There should be a marked difference in contrast between the dim and intensified portion of the trace. An adjustment of the scope INTENSITY controls may be necessary.

4.5.2.4.3 Adjust the FOCUS and ASTIGMATISM controls on the scope for a clear trace with sharply defined ends to the intensified portion.

4.5.2.4.4 Adjust the LOCATOR WIDTH-WIDE control (R17) located on the sweep control assembly (A1A4) until the intensified portion of the sweep is one centimeter long (one graticule square). The FREQUENCY control on the EMC-25 may be adjusted so the intensified portion of the sweep lies within one graticule square.

4.5.2.4.5 Turn the DISPERSION control on the front of the PP-125 fully CCW. Adjust the LOCATOR WIDTH-NARROW control (R46) located on the sweep control assembly (A1A4) until the intensified portion of the trace appears as a small dot. This adjustment is made until the dot is as small as possible, but not dimmed.

4.5.2.4.6 Turn the FUNCTION switch on the front of the PP-125 to VIDEO. Insert an 80 KHz, 100 uV signal into the EMC-25. Adjust the TUNING and CAL controls of the EMC-25 for a full scale deflection of the meter.

4.5.2.4.7 Turn the FUNCTION switch located on the front of the PP-125 to LOCATOR. With the DISPERSION control fully CCW, adjust the LOCATOR POSITION control (R27) on the sweep control assembly (A1A4) until the intensified dot is positioned at the very top of the response curve (trace).

4.5.2.5 SIGNATURE ADJUSTMENTS

4.5.2.5.1 Set the FUNCTION switch located on the front of the PP-125 to SIGNATURE. Set the DISPERSION fully CCW. Set the BANDWIDTH switch in the front of the EMC-25 to NARROW. The resulting expanded response should reach its maximum amplitude at the vertical center graticule line on the scope. A slight readjustment of the TUNING BAL control (R30) on the sweep control assembly (A1A4) can be made if necessary.

4.5.2.5.2 Rotate the DISPERSION control on the front of the PP-125 fully CW. Adjust the SIGNATURE SYMMETRY control (R26) on the sweep control assembly (A1A4) so the maximum amplitude point of the trace remains at the center vertical graticule line on the scope.

4.5.2.5.3 Set the FUNCTION switch on the front of the PP-125 to LOCATOR. Readjust the signal generator frequency until the maximum amplitude point of the trace occurs at the extreme left end of the intensified portion. If the amplitude of the trace decreases when the FUNCTION switch setting is changed, decrease the horizontal sweep speed of the SPD-125 until the amplitude of the trace remains constant for different FUNCTION settings.

4.5.2.5.4 Set the FUNCTION switch on the front of the PP-125 to SIGNATURE. Adjust the SIGNATURE RANGE control (R19) on the sweep control assembly (A1A4) until the maximum amplitude of the trace occurs at the extreme left end of the trace. Readjust controls according to paragraphs 4.5.2.1 through 4.5.2.5.4 until all interaction ceases.

4.5.2.5.5 Set the FUNCTION switch on the front of the PP-125 to LOCATOR. With the DISPERSION still fully CW, readjust the signal generator frequency until the maximum amplitude of the trace occurs at the extreme right end of the intensified portion.

4.5.2.5.6 Set FUNCTION switch on the front of the PP-125 to SIGNATURE. The maximum amplitude of the trace should occur at the extreme right end.

NOTE

To achieve the above condition of coincidence between the maximum amplitude point and the extreme right end of the intensified portion of the trace, slight readjustments of the TUNING BAL (A1A4R30), SIGNATURE SYMMETRY (A1A4R26), SIGNATURE RANGE (A1A4R19), and LOCATOR WIDTH-WIDE (A1A4R17) may be required. The most optimum alignment is desired.

4.5.3 SPECTRUM DISPLAY PP-125, IF GAIN ADJUSTMENTS

4.5.3.1 The initial settings of the PP-125 and associated equipment should be as described in Table 4-2.

4.5.3.2 175 KHz IF GAIN ADJUSTMENT

4.5.3.2.1 Disconnect the AM VIDEO cable from the PP-125. Adjust the POSITION control on the PP-125 until the trace is superimposed on the

bottom line of the scope graticule (-∞). Reconnect the AM VIDEO cable.

4.5.3.2.2 With a 100uV 80 KHz input signal to the EMC-25, adjust the EMC-25 CAL control until the scope trace deflection caused by the input signal is full scale with the display switch in LOG position.

4.5.3.2.3 Set the DISPLAY switch to LIN. Adjust the 175 MHz GAIN control (A1A3R9) until the signal amplitude coincides with the third line from the top of the scope graticule (100%).

4.5.3.3 1.6 MHz IF GAIN ADJUSTMENT

4.5.3.3.1 The procedure for adjustment of the assembly is the same as that for the 175 KHz IF assembly with the following exceptions.

4.5.3.3.2 The EMC-25 bandswitch is set to band 8 (2.3 to 5.3 MHz).

4.5.3.3.3 The signal generator is set to 4.0 MHz maintaining 100 uV output.

4.5.3.3.4 Adjust the 1.6 MHz GAIN control (A1A2R9) until the marker amplitude corresponds to the third line from the top of the scope graticule (100%).

4.5.3.4 8.7 MHz IF GAIN ADJUSTMENT

4.5.3.4.1 The procedure for adjustment of this assembly is the same as that for the 175 KHz IF assembly with the following exceptions.

4.5.3.4.2 The EMC-25 bandswitch is set to band 11 (22 to 51 MHz).

4.5.3.4.3 Set the signal generator output to 40 MHz with an amplitude of 100 uV.

4.5.3.4.4 Adjust the 8.7 MHz GAIN control (A1A1R9) until the marker amplitude coincides with the third line from the top of the scope graticule (100%).

4.5.4 RECORDER INPUT ADJUSTMENTS

4.5.4.1 RECORDER INPUT ADJUSTMENT TEST SETUP (Figure 4.3). Figure 4.3 shows the required test setup for adjustments necessary prior to the use of an X-Y recorder.

4.5.4.1.1 Set the scope vertical input to DC. Calibrate the scope such that the bottom line on the scope graticule corresponds to 0 V and that 1.5 V can be read accurately.

4.5.4.1.2 Synchronize the scope sweep so the X output of the PP-125 (J6-MM) appears as two cycles of sawtooth on the scope.

4.5.4.1.3 Adjust the X-OUT ZERO ADJ (R9) on the sweep control assembly (A1A4) until the Nulls of the sawtooth voltage reach 0 V. Adjust the X output amplifier (R1 on the sweep control assembly (A1A4) until the peaks of the sawtooth voltage reach 1.5 V). Readjust R9 and R1 as needed to insure a 0 V to 1.5 V sawtooth.

4.5.4.1.4 Adjust the POSITION control on the front of the PP-125 until the SPD-125 trace coincides with the bottom graticule line.

4.5.4.1.5 Adjust the Y-OUT ZERO ADJ (R26) of the Video assembly (A1A5) until a voltmeter (connected to J6-LL) reading of 0 V is obtained.

4.5.4.1.6 Readjust the POSITION control on the front of the PP-125 until the SPD-125 trace coincides with the top line of the graticule.

4.5.4.1.7 Adjust the Y-OUT GAIN ADJ (R22) on the Video assembly (A1A5) until the voltmeter reading obtained is 1.5 volts.

4.5.4.1.8 Repeat steps 4.5.4.1.4 through 4.5.4.1.7 until interaction ceases.

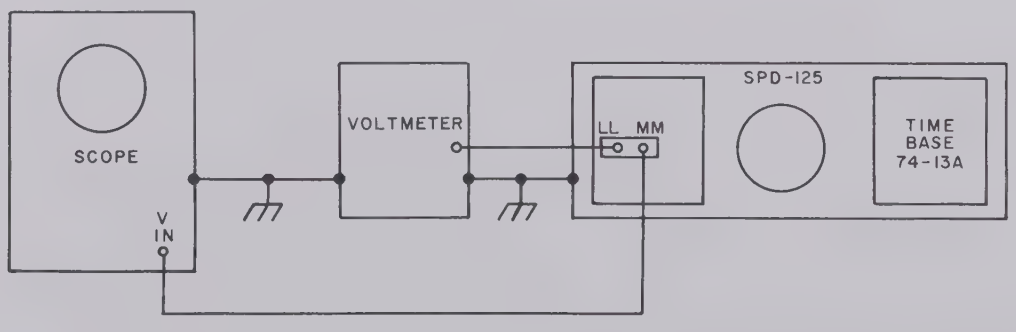


Figure 4.3 Recorder Input Adjustments, Test Setup

4.6 TROUBLESHOOTING

4.6.1 Whenever a malfunction occurs, it can readily be isolated to a particular assembly. The following paragraphs contain suggested procedures to be followed that will isolate a trouble to a particular assembly.

4.6.1.1 IF AMPLIFIER MALFUNCTION. If a malfunction is suspected to be within one of the IF amplifier assemblies, the procedures outlined in Section 4.3 may be followed. If the adjustments contained in 4.5.3.2 fail to respond, the malfunction is in the 175 KHz amplifier assembly. Isolation of the malfunction to the 1.6 MHz IF amplifier assembly can be achieved if the instrument does not respond to the procedure outlined in paragraph 4.5.3.3. Isolation of the malfunction to the 8.7 MHz IF amplifier assembly can be achieved if the instrument does not respond to the procedure outlined in paragraph 4.5.3.4.

4.6.1.2 VIDEO AMPLIFIER MALFUNCTION. Using the test setup in Figure 4.2 and injecting AM VIDEO from the EMC-25, the IF Amplifiers are bypassed completely. If the trace on the SPD-125 does not conform, the trouble is contained in the Video amplifier assembly.

4.6.1.3 SWEEP CONTROL MALFUNCTION. If the malfunction is suspected to be in the sweep control assembly, the procedures outlined in paragraph 4.5.2 may be followed. If one of them fails to respond, the malfunction is located in the sweep control assembly.

4.7 ASSEMBLY REPAIR

4.7.1 The repair of the suspected assembly can be effected only after the problem is isolated to a stage or a single component part. The usual signal tracing, voltage and/or continuity checking will, under normal circumstances, isolate the trouble to a functional stage within the defective assembly. Care must be taken not to damage the circuitry on the individual assemblies whenever replacement or component parts are undertaken.

4.7.2 Individual assemblies may be purchased to replace any that are defective. Defective assemblies may be returned to the factory for repair or replacement.

4.7.3 New or repaired assemblies must be subjected to a complete calibration and adjustment as outlined in this section, whenever they are returned to use as an integral part of the Spectrum Analyzer, CSR-200.

SECTION V
REFERENCE DATA

5.1 GENERAL

5.1.1 This section contains information which will be helpful in signal tracing during instrument checkout and/or maintenance. Figure 5.1 is a schematic location guide followed by electrical drawings. These electrical drawings are presented, as near as possible, in the order of signal flow within the instrument. Physical location according to designators was also considered.

5.1.2 As an example, to locate the schematic of the video amplifier (A1A5), check the block titled video amplifier for the figure number (Figure 5.7).

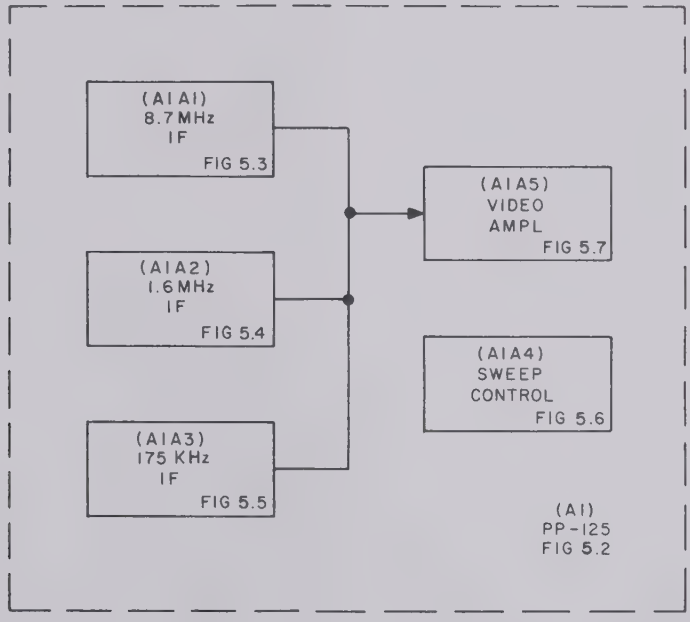
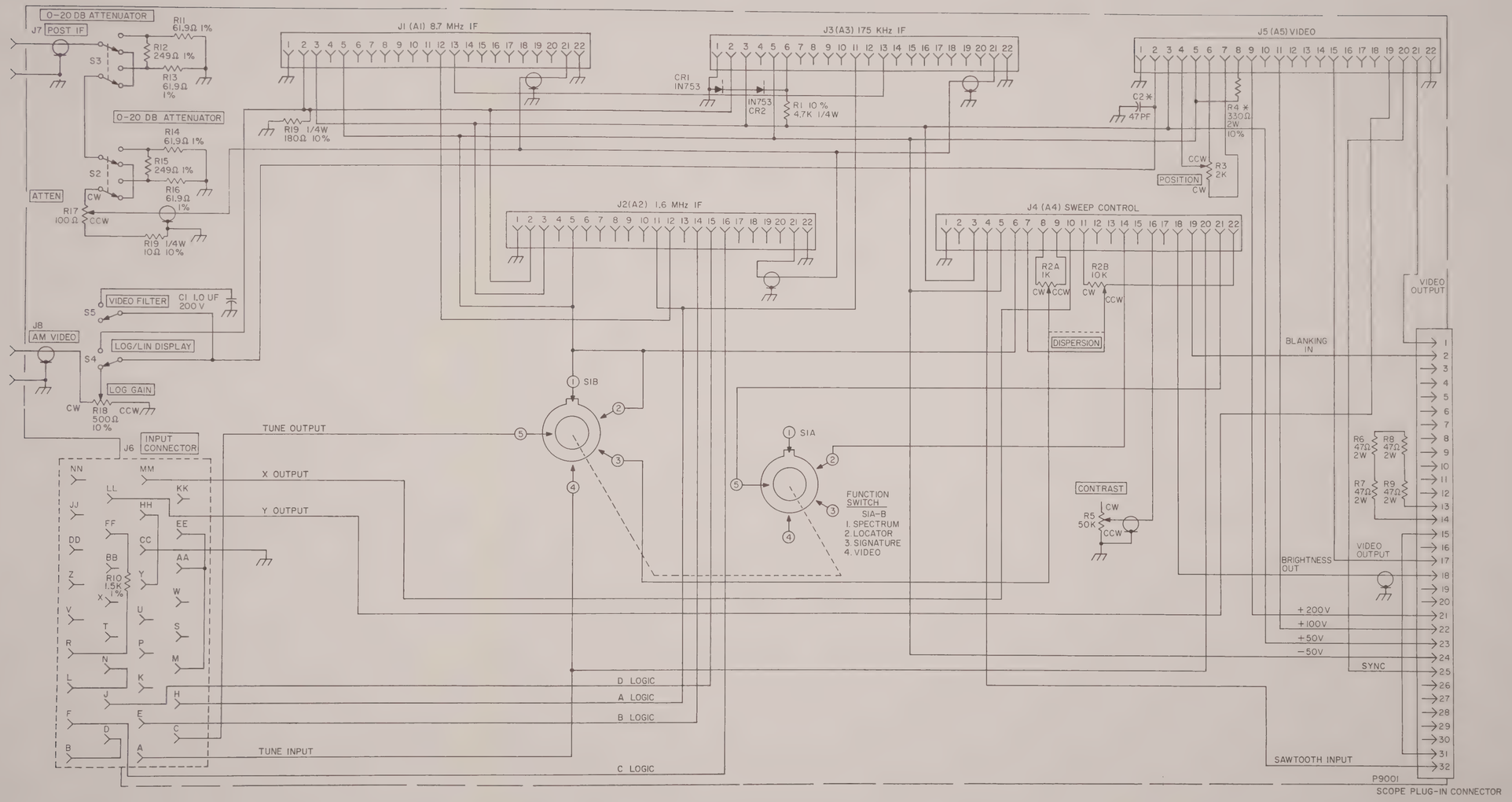
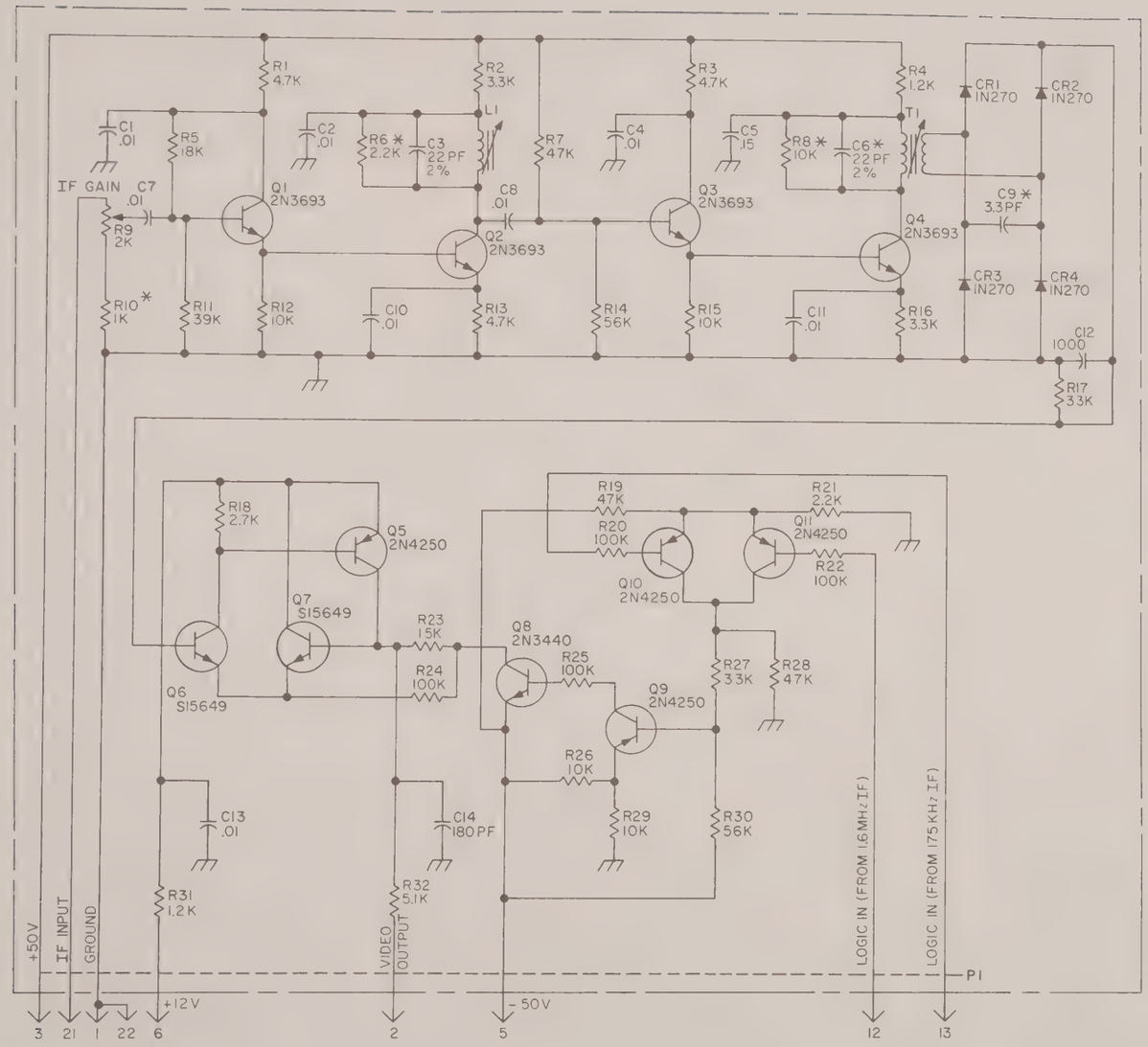


Figure 5.1 Schematic Location Guide



NOTES:
1. COMPONENTS MARKED * ARE FACTORY ADJUSTED
2. FOR COMPLETE PART NO., USE PREFIX AS SHOWN ON ASSY., EX.: R5 ON ASSY. A1P2 COMPLETE PART NO. IS (A1P2-R5)

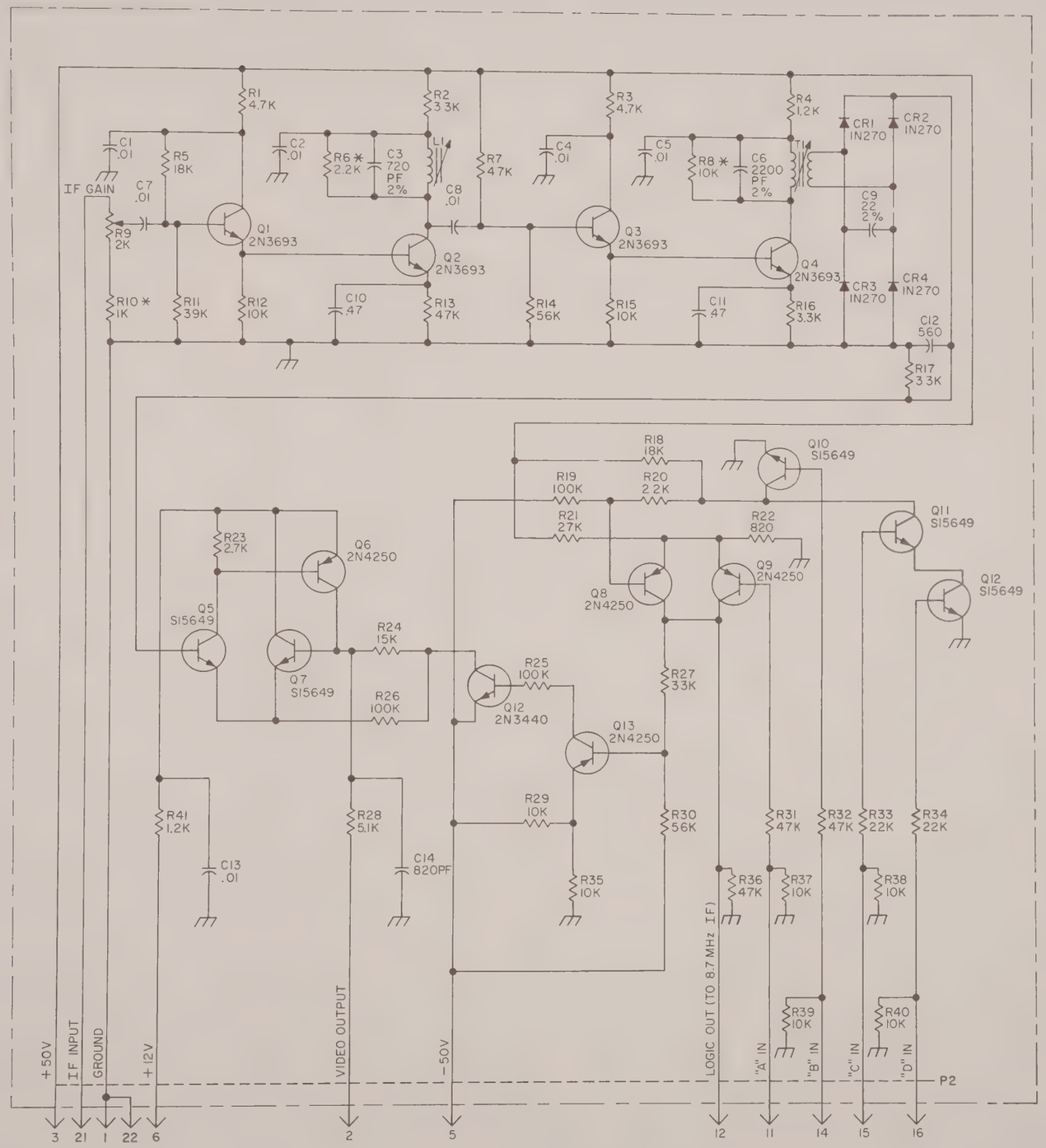
Figure 5.2 Spectrum Display PP-125, Main Chassis (A1)



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, ± 10%
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS VALUES ARE IN MICROFARADS, ± 10%.
3. COMPONENTS MARKED * ARE FACTORY ADJUSTED.
4. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSEMBLY EXAMPLE: R5 ON ASSEMBLY A1A1 COMPLETE PART NUMBER IS (A1A1–R5)

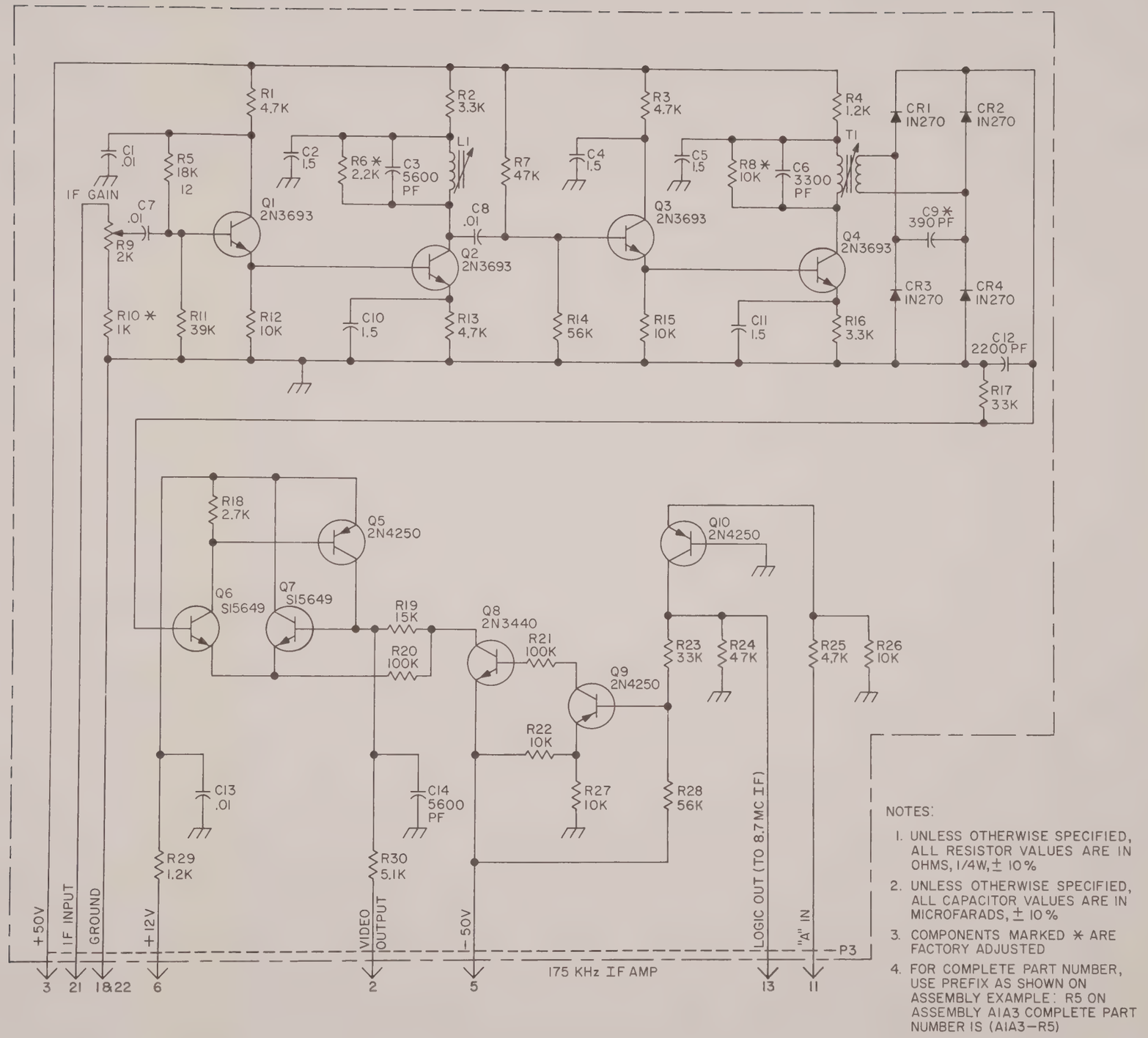
Figure 5.3 8.7 MHz IF Amplifier (A1A1), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ± 10%
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 10%
3. COMPONENTS MARKED * ARE FACTORY ADJUSTED
4. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSEMBLY EXAMPLE: R5 ON ASSEMBLY A1A2 COMPLETE PART NUMBER IS (A1A2—R5)

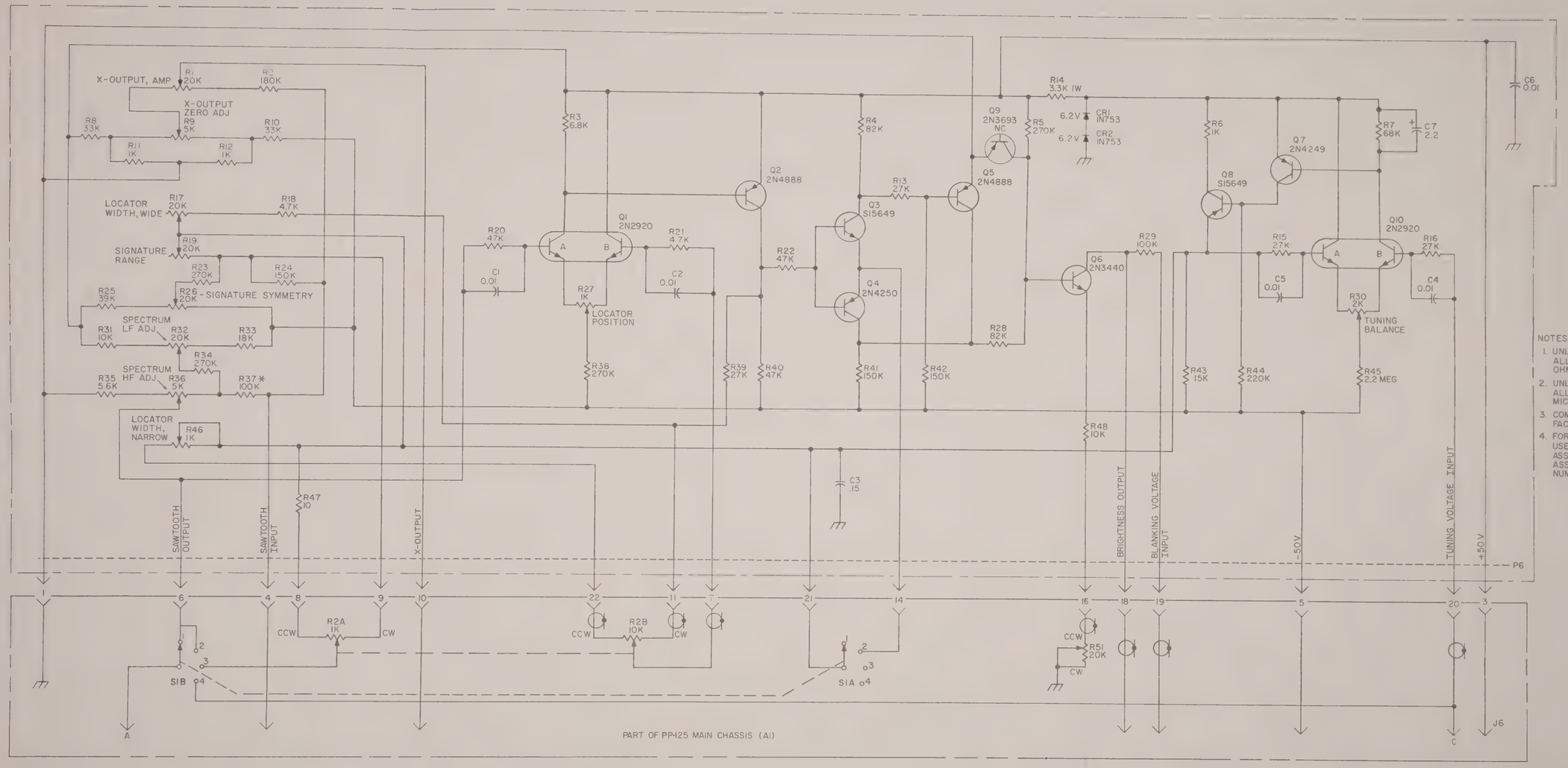
Figure 5.4 1.6 MHz IF Amplifier (A1A2), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ± 10%
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 10%
3. COMPONENTS MARKED * ARE FACTORY ADJUSTED
4. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSEMBLY EXAMPLE: R5 ON ASSEMBLY A1A3 COMPLETE PART NUMBER IS (A1A3-R5)

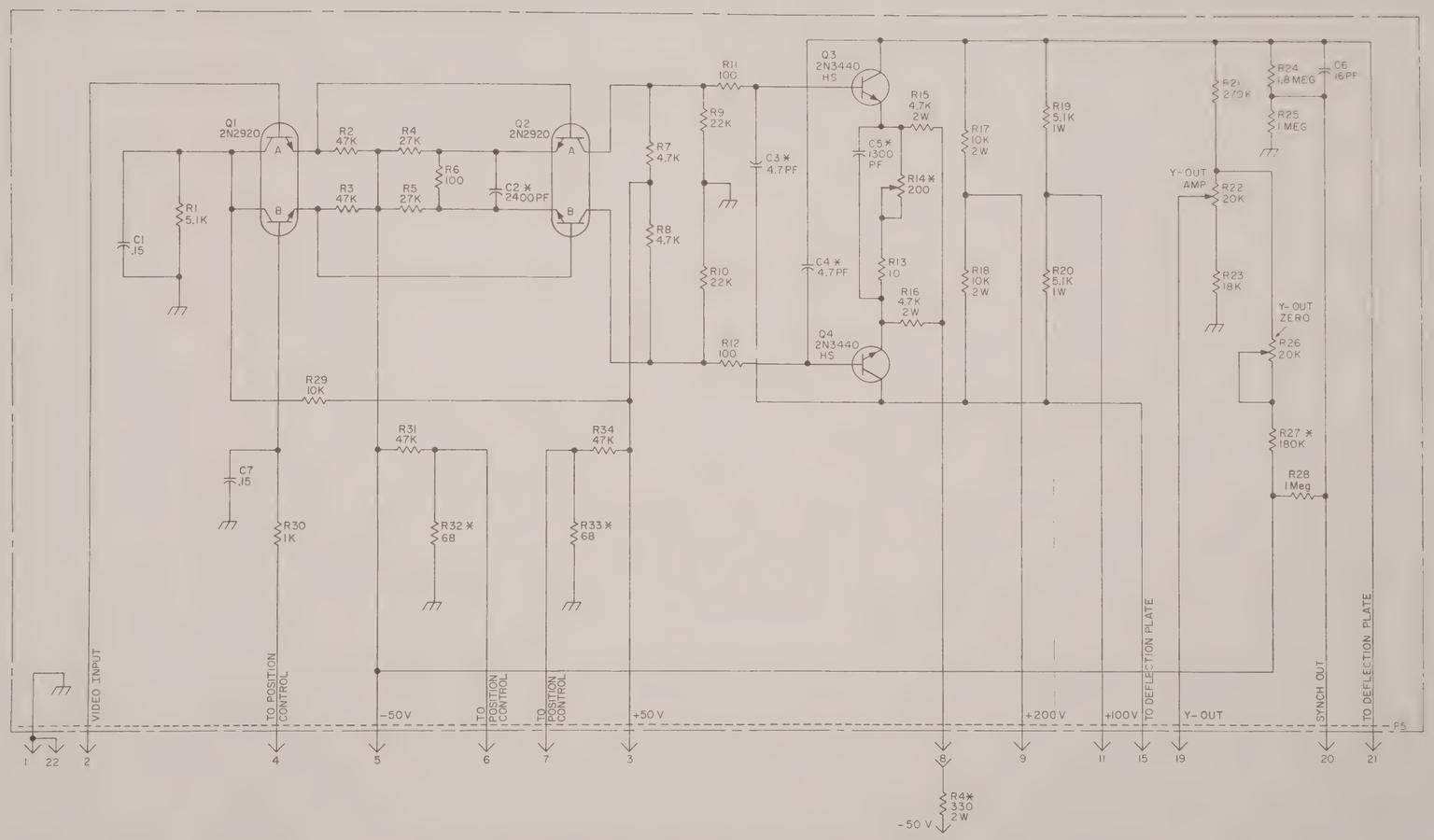
Figure 5.5 175 KHz IF Amplifier (A1A3), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ± 10%
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ± 10%
3. COMPONENTS MARKED * ARE FACTORY ADJUSTED
4. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSEMBLY EXAMPLE R5 ON ASSEMBLY A1A4 COMPLETE PART NUMBER IS (A1A4-R5)

Figure 5.6 Sweep Control (A1A4), Schematic Diagram



NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±10%
2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITOR VALUES ARE IN MICROFARADS, ±10%.
3. COMPONENTS MARKED * ARE FACTORY ADJUSTED.
4. FOR COMPLETE PART NUMBER, USE PREFIX AS SHOWN ON ASSEMBLY EXAMPLE: R2 ON ASSEMBLY A1A5 COMPLETE PART NUMBER IS(A1A5—R5)

Figure 5.7 Video Amplifier (A1A5), Schematic Diagram

TYPE

765
766
767

SERIES

OSCILLOSCOPE MANUAL

Serial No. _____

FAIRCHILD

INSTRUMENTATION

50 Somerset Place, Clifton, New Jersey, U.S.A.

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Manual No. 6704 5894
Code No. ⟶
(Inside Cover)

Portascope Model		Bench Model		Rack Model	
Type	Code	Type	Code	Type	Code
765	26	766	28	767	30
765H	27	766H	30	767H	31
765H/F	27	766H/F	30	767H/F	31
765M	26	766M	28	767M	30
765MH	27	766MH	30	767MH	31
765MH/F	27	766MH/F	30	767MH/F	31

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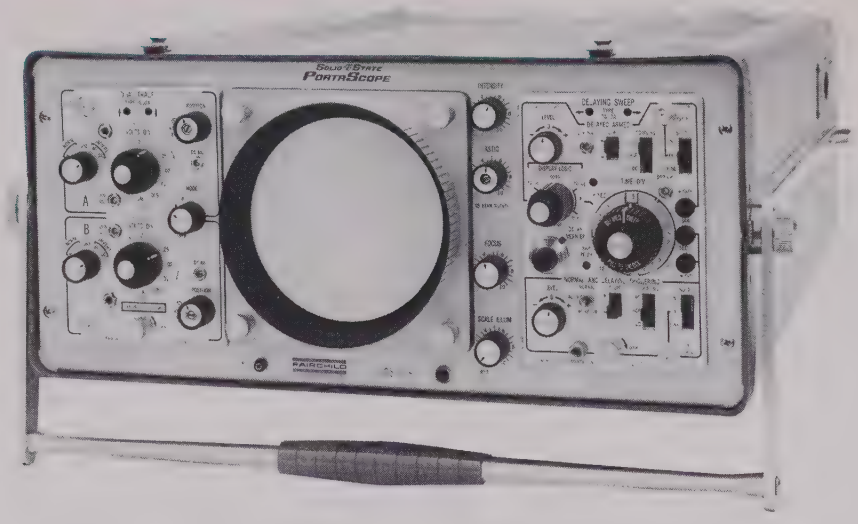


FIGURE 1-1. TYPE 765 PORTASCOPE

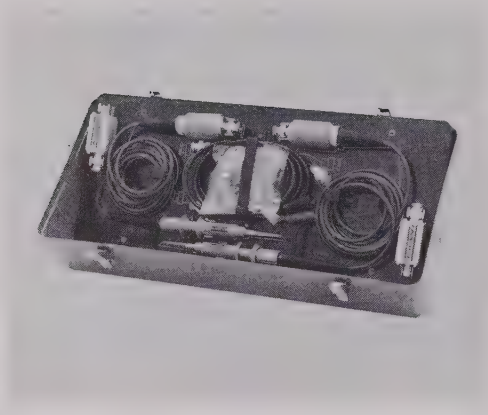


FIGURE 1-2. TYPE 765 COVER WITH ACCESSORY PANEL

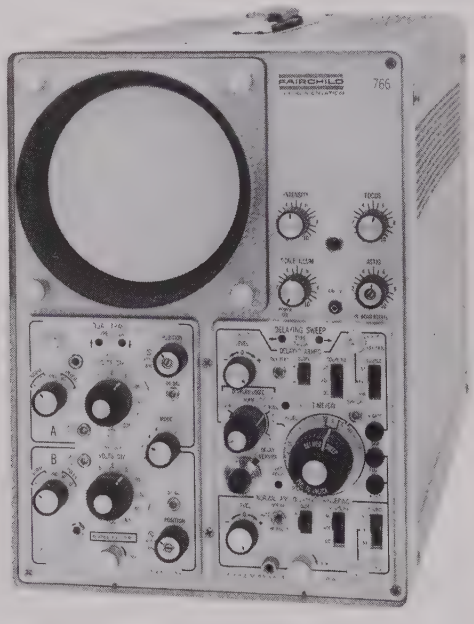


FIGURE 1-3. TYPE 766 BENCH MODEL

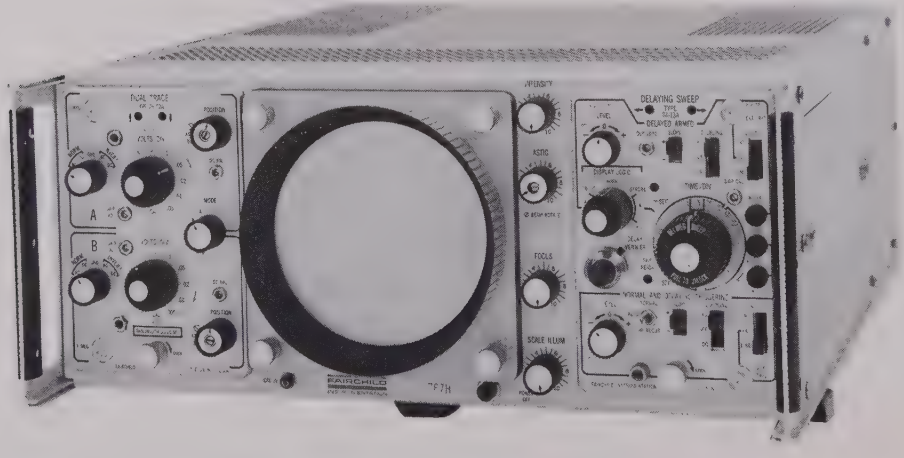


FIGURE 1-4. TYPE 767 RACK MODEL

SECTION 1
TECHNICAL SUMMARY

1.1 INTRODUCTION (Figures 1-1 to 1-4)

The Fairchild Types 765, 766, and 767 Family of Oscilloscopes are available in three basic form factors: bench, rack, and portable models. The Portable Models are identified by the Type 765 numerical Series; the Bench Models by the Type 766 numerical Series, and the Rack-mounted Models by the Type 767 numerical Series.

In addition, there are alphabetical suffixes appended to the numerical series to identify special electronic circuits. The suffix H denotes the high-voltage oscilloscope with an accelerating potential of 13 Kv. The low voltage option is 5 Kv and these series oscilloscopes are identified by the absence of the H alphabetical suffix.

The suffix H/F denotes the high-voltage, high-frequency model. These models are provided with the Type 7062 CRT Termination Network to enable them to accommodate the Type 79-02A DC to 100 Mc Plug-in Amplifier. The suffix M denotes the militarized model. Further details for all of the models are listed in the Specifications.

Since the electrical circuits are identical in all models except for minor differences, discussion will be confined to the Type 766H Series Oscilloscope. All references to the Type 766H Series will be equally applicable to the other models unless otherwise indicated.

To simplify discussion, the Type 766H Series Oscilloscope may be categorized into three basic Series: (1) Low-voltage, (2) High-voltage, and (3) High Frequency.

1. The following models comprise the low-voltage Series:

   Type 765, 765M, 766, 766M, 767, and 767M

2. The following models comprise the high-voltage Series:

   Type 765H, 765MH, 766H, 766MH, 767H, 767MH

3. The following models comprise the high-frequency Series:*

   Type 765H/F, 765MH/F, 766H/F, 766MH/F, 767H/F, & 767MH/F

**Note:* These oscilloscopes are electrically identical to the high-voltage series except for the addition of the high-frequency CRT Termination Network.

Separate manuals are provided for each of the plug-in units. If desired, these manuals may be inserted into the same binder supplied with your Indicator unit.

1-2. FEATURES

The Fairchild Family of Oscilloscopes consists of an Indicator Unit and any two of a number of available plug-in modules. The Indicator Unit contains the power supplies, a cathode-ray tube with associated circuitry, and an internal amplitude calibrator.

The plug-in modules take the place of the vertical and horizontal deflection systems of a conventional oscilloscope, and their outputs are connected directly to the deflection plates of the cathode-ray tube.

All plug-ins in the Type 74-00 and 76-00 Series may be used universally in the oscilloscope. The plug-in modules may be selected to give a degree and type of performance demanded of them by the particular application for which they are to be used.

- 13 Kv accelerating potential (low-voltage option: 5 Kv)
- Quality display area of 6 cm by 10 cm
- Three basic Main Frames available: Portable (Type 765-), Bench (Type 766-) and Rack-mounted (Type 767-)
- Silicon solid state circuitry
- Dual Plug-in capability (DC to 100 Mc) with all High Frequency or H/F Models
- Z-axis input provided on all bench and rack-mounted models
- Illuminated internal graticule optionally available
- Silicon transistors and fully regulated electronic power supplies, assure maximum drift stability and long-term reliability

1-3. LIST OF RECOMMENDED ACCESSORIES

Type or Part Number		Description
ATTENUATOR PROBES		
(10:1 terminated in BNC type connector)		
	4289B	
4289B, MOD 101	4290B	10M, 10pf; 4-ft cable
4289B, MOD 102	4298B	10M, 14 pf; 8-ft cable
4292B	4299B	10M, 12 pf; 6-ft cable
4309B	7994B*	10M, 7 pf; 4-ft cable
	7999B*	10M, 9 pf; 9-ft cable
COLOR FILTERS		
4800 5861		Amber for P7 screen
4800 5862		Blue for P11 or P7 screen
4800 5863		Green for P2 and P31 screen
4800 6101		Neutral, circularly polarized
4501 0452		Anti-parallax scale
SCOPE TRAVELERS & RACK SLIDE		
7020		Top Tray: 10¾ inches x 22½ inches; 26½ inches from floor
7030		Top Tray: 17¾ inches x 22½ inches; 32½ inches from floor
7085A		Slide drawer (for rack-mounted unit) See Figs. 1-6 to 1-8.
TERMINAL ADAPTERS		
7084		Male BNC type connector to Type C female adapter, UG-635/U
7080		Scope binding post to BNC adapter
VIEWING ACCESSORIES		
276C		Viewing Hood made of molded rubber
7035		Round light shield to reduce glare and reflection; does not have a molded eyepiece
TERMINATING RESISTOR		
4285A		50-ohm, 5-watt, Type C connector
CAMERAS		
450/450A, 453/453A		Oscilloscope-Record Cameras with suitable accessories
CABLE ASSEMBLY		
4294		Extension cable for remote operation of the plug-in from the oscilloscope
OPERATIONAL ACCESSORY KIT		
4296		Complete kit contains:

Qty	Type	Description
1	276C	Viewing Hood
2	4285A	50-ohm Termination
1	4290	Probe

OPERATIONAL ACCESSORY KIT (Cont)

Terminal Adapters

Qty	Type	Description
2	4287	Right angle; UG-306A/U
2	UG-636/U	C male to BNC female
2	UG-1090/U	BNC to plug tip (banana)

CRT TERMINATION NETWORK

7062	CRT Termination Network Kit to transform the H models to H/F models. This network is standard equipment with the High-Frequency Main Frame Oscilloscopes (Types 765H/F, 765MH/F, 766MH/F, 766H/F, 767H/F and 767MH/F)

1-4. TECHNICAL SUMMARY (Specifications)

The electrical and physical characteristics of the Types 765, 766 and 767 Series Oscilloscopes are listed in the following Performance Specification. The technical characteristics of the Type 765 MH militarized version of the Type 765, are listed under a separate paragraph.

CATHODE-RAY TUBE DATA

Type

Low-Voltage Series

(765, 765M, 766, 766M, 767 & 767M)

F7650-0-P31 single beam, electrostatic focus and deflection cathode-ray tube is normally supplied; 5000 volts accelerating potential

High-Voltage Series

(765H, 765MH, 766H, 766MH, 767H & 767MH)

F7660-0-P31 single beam, electrostatic focus and deflection cathode-ray tube is normally supplied; 13,000 volts accelerating potential

High-Frequency Series

765H/F, 765MH/F, 766H/F, 766MH/F, 767H/F, & 767MH/F)

F7670-0-P31 single beam, electrostatic focus and deflection cathode-ray tube is normally supplied; 13,000 volts accelerating potential

Optional Phosphors

P7 phosphor for long persistence low frequency or transient observation; P11 phosphor for photographic use; and P2 phosphor for combination visual and photographic use. All other phosphors available on special order

Aluminization

All tubes are aluminized for maximum light output and to prevent screen charge distortions

Bezel

Light-tight bezel provides firm mount for an oscilloscope camera and permits ready interchange of filters and scales

SPECIFICATIONS

Graticule

Engraved edge-lit graticule having 6 cm by 10 cm graduations and appropriate color filter over face of tube. Scale illumination control varies light level from zero to intensity adequate for photographic recording. CRT internal no-parallax graticule is optionally available; white scale may be edge lit for photographic recording

CRT Direct Input

1. X Axis: 10 to 15 volts/cm (all CRT series)
2a. Y Axis: 5.2 to 7.2 volts/cm (F7650-0-P- and F7660-0-P- CRT only)
2b. Y Axis: 2½ to 3½ volts/cm (F7670-0-P- CRT only)

Z Axis (Bench and Rack-mounted Models only)

Negative pulse to grid of CRT blanks trace. 25 volts are required into an impedance of approximately 1 megohm coupled via 0.01 μf capacitor to dim trace

CRT Beam Controls

INTENSITY, FOCUS, and ASTIG controls are provided on the Main Frame for controlling the CRT beam

Beam Brightening

A switch labeled NORMAL/SINGLE is provided on the Type 766 High-Voltage and High-Frequency Series chassis. Beam brightening can be accomplished by beam gating (normal operation) or by cathode gating (for photographing single-shot high-speed transients)

VOLTAGE CALIBRATOR

Amplitude

Cal 1V, peak-to-peak square wave signal available at pin jack on front panel of Main Frame (±2.5% maximum, ±1% nominal); fast rise and fall time permits adjustment of attenuator probe

Accuracy

Nominally ±1%, always within ±2.5%

Frequency

Locked to power-line frequency. This waveform may be used to calibrate the time axis wherever the power-line frequency is controlled standard

Access to Plug-Ins

The same 1-volt calibrator waveform is supplied to each plug-in. The amplifier plug-ins will be provided with a suitable arrangement for calibration of all active circuitry. The calibrator waveform will normally be inserted into the input stage by means of the VOLTS/DIV switch

POWER REQUIREMENTS

Line Voltage

From 105 to 125 volts or from 210 to 250 volts at 60-cycle line

Line Frequency

Operation from 48 through 1000 cycles; line voltage excursion is reduced at extremes of frequency range and where power line distortion exceeds 5%

Power

From 150 to 230 watts depending on the plug-in used

DC Power Supplies

All supplies are electronically regulated

ENVIRONMENTAL SPECIFICATIONS*

Operating Temperature Range

From 0°C to 50°C. All models incorporate a thermal cutout switch to protect the unit when cooling is insufficient. Adequate ventilation and clearance around unit must be provided in rack-mounted installation to assure intake air below the specified ambient temperature

Storage Temperature Range

From −40°C to +85°C

Altitude Range

Sea level to 15,000 feet

Humidity

Constant operation at 30°C and 80% relative humidity. Intermittent operation under all humidity and temperature specifications that prevent condensation

Shock

10G shock for duration of 25 milliseconds

Vibration

15-minute cycle from 10 to 33 cycles at 0.015 inches double amplitude; vibrates in 3 planes

* Applicable for all models except militarized or "M" Models.

Data for "M" models is given elsewhere in this Specification.

PHYSICAL CHARACTERISTICS

	Portable Models 765-	*Bench Models* 766-	*Rack-Mounted Models* 767-
Height	8¼″	13¾″	7″
Width	17¾″	9¾″	19″
Depth	23″	20⅝″	20″*
Weight	18 lbs	27 lbs	27 lbs
Carrying Case	9 lbs	—	—
Shipping Weight	37 lbs	37 lbs	37 lbs

Note: A minimum of 2″ clearance must be maintained for the rack-mounted model to assure adequate cooling. Do not subject the unit to the hot exhaust air of adjacent equipment.

* Behind panel. With mounting brackets reversed: 18¾ inches

TYPE 7085 RACK INSTALLATION

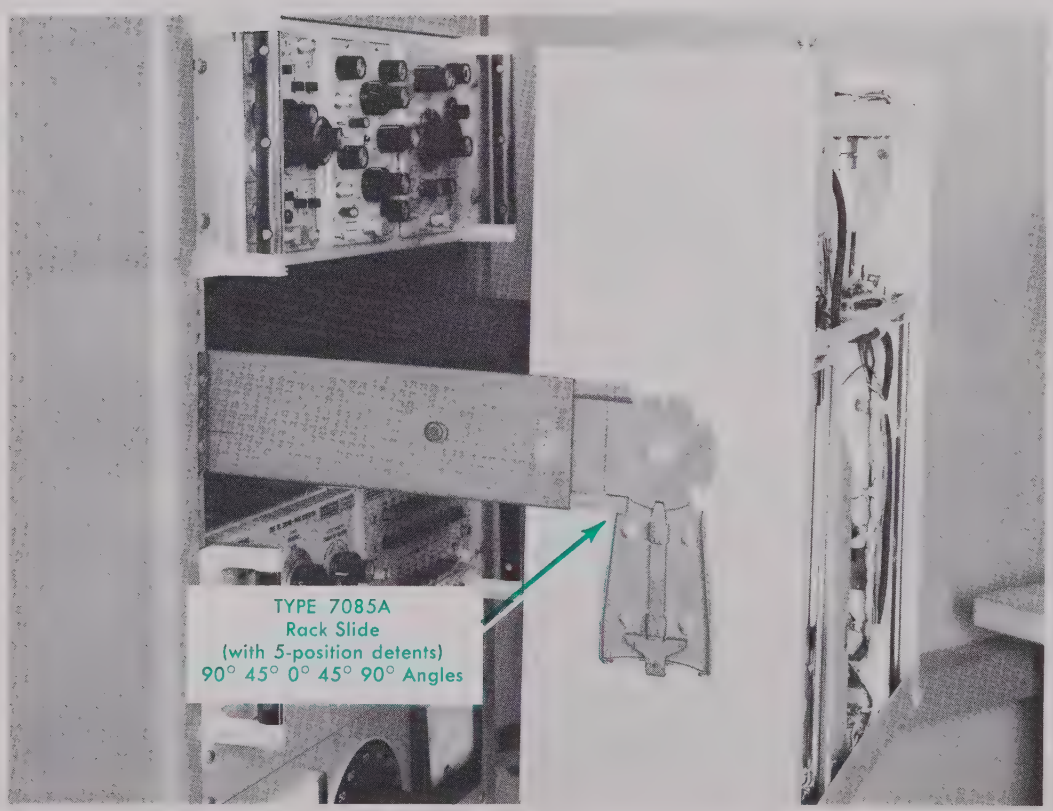


Figure 1-5. Type 7085A Rack Slide Set to 90° with Type 767H Oscilloscope Installed

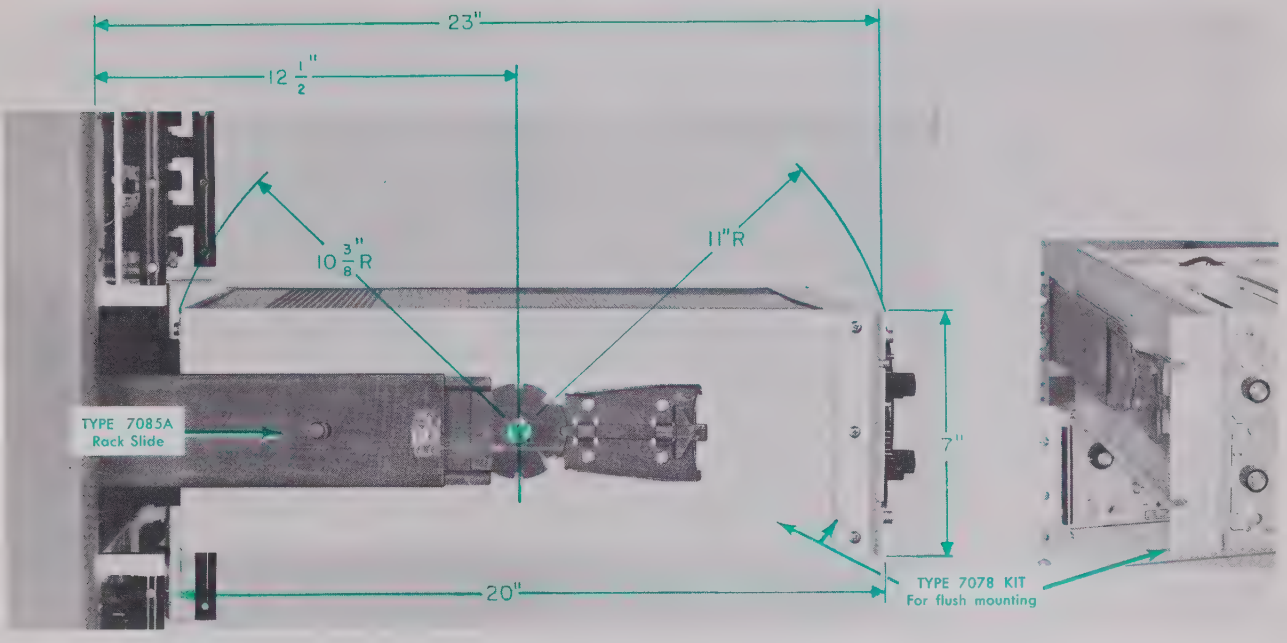


Figure 1-6. Type 767H Oscilloscope Showing Clearance Dimension for Installation of Type 7085A Rack Slides and Type 7078 Kit for Flush Mounting

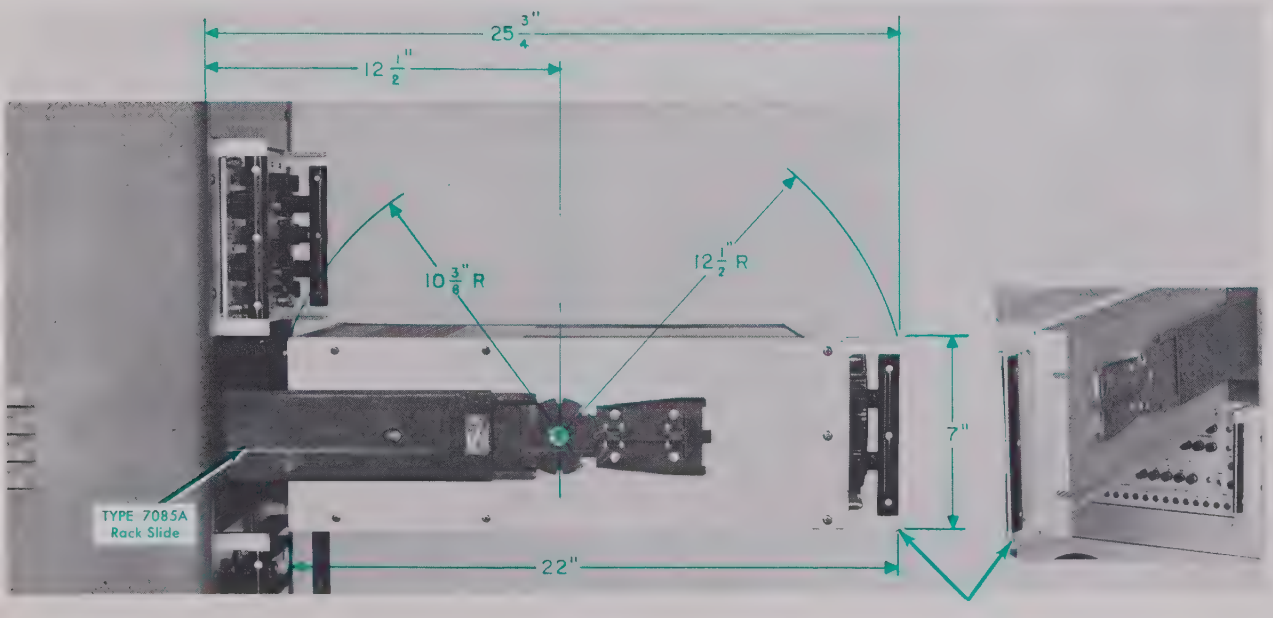


Figure 1-7. Type 767H Oscilloscope Showing Clearance Dimension for Installation of Type 7085A Rack Slides (Standard Installation)

1-5. TYPE 765MH TECHNICAL DATA

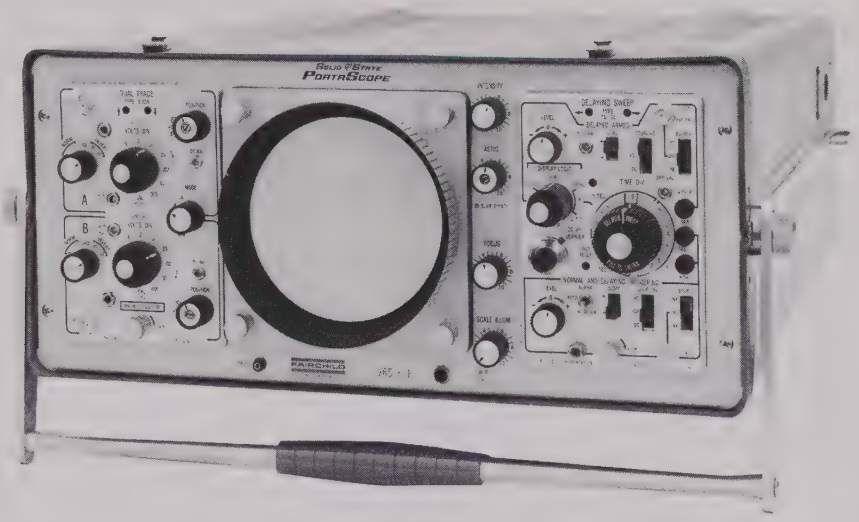


Figure 1-8. Type 765MH

MILITARIZED PORTASCOPE®

- Meets ruggedized military specifications
- Operation from line power frequencies of 48-1000 cycles
- Low power consumption
- Operation from −30° to +60°C
- Semiconductor circuitry
- Light weight — extremely portable
- RFI shielding
- Federal Stock Number 6625-056-7115
- Each unit is vibration tested
- Certification of compliance supplied with each system

The 765MH is a militarized, rugged, portable oscilloscope. The unit is housed in a sturdy fiberglas case. A convenient carrying handle permits easy transport through narrow aisles, hatchways or any confined area. A fiberglas cover is provided with facilities for mounting accessories.

This basic indicator houses the CRT, power supplies, and has two cavities into which various X and Y plug-ins may be inserted. All electrical specifications are identical to the 765H Series.

Heater Strips — A 200-watt thermostatically controlled standby heater is incorporated for low temperature operation. 200 watts of additional standby power are required below 0°C.

Weight — The weight of this unit including plug-ins is less than 35 pounds. Main frame weight is under 27 pounds. Case and covers are constructed of rugged fiberglas material. An RFI metallic coating is sprayed inside the case.

Temperature Range (in all positions) —

Storage	−40°C to +85°C
Operating	−30°C to +50°C (without fan)
	−30°C to +60°C (with fan) (modification 103)

Operational Altitude —

Operational to 15,000 feet

Non-operating to 50,000 feet

Humidity — Constant operation at 40°C and 95% relative humidity. Intermittent operation under all humidity temperature specifications which prevents condensation. Meets MIL standard 202B method 106A except freezing. No condensation permitted when operating.

Shock —

20 G shock for duration of 5 ms
15 G shock for duration of 11 ms
10 G shock for duration of 25 ms
(4 shocks in each plane for a total of 12 shocks.)

Vibration — 15-minute cycle from 10 to 3000 cycles at 0.010 inches double amplitude (peak-to-peak). Vibrated in 3 planes, 15-minutes in each plane **(2 G limit)** with a 5-minute scan cycle. 15-minute cycle from 10 to 3000 cycles at 0.025 inches double amplitude (peak-to-peak). Vibrated in 3 planes, 15-minutes in each plane **(5 G limit)** with a 30-second scan cycle. Four web guides are provided for mounting the fiberglas case.

Transit — Unit will meet National Safe Transit Specifications when factory packaged. Vibration for one hour at 1.2 G 30-inch drops on corners, edges and flat surfaces.

Height —	8¼″	20.9 cm
Width —	17¾″	45.0 cm
Depth — (with cover)	23″	58.4 cm

Weight —
Net — 27 pounds Shipping — 37 pounds

SECTION 2
OPERATING INSTRUCTIONS

2-1. INTRODUCTION

This section of the Instruction Manual describes the operation of the Indicator Unit with the Plug-in modules inserted. Operation of the Indicator Unit with the plug-in modules inserted is the same as that of a conventional oscilloscope with corresponding vertical and horizontal deflection systems. Full operating instructions for each of the plug-in modules are contained in the manual which accompanies it.

2-2. PRELIMINARY INFORMATION

The Type 766H/F Oscilloscope is a general purpose, wide band laboratory instrument with dc to 100 Mc capabilities. The dual cavities of the instrument will accept any of the present Types 74-00, 76-00, and 79-00 Series Plug-ins, thus determining the oscilloscope's ultimate performance. The Type 766H/F Oscilloscope is in essence a Type 766H Series unit which has been provided with the Type 7062 CRT Termination Network to accommodate the Type 79-02A 100 Mc Dual Trace Amplifier Plug-in. For the militarized or "M" models, a 200-watt thermostatically-controlled standby heater is incorporated for low temperature operation.

The low-voltage power supply provides regulated and unregulated voltages for application throughout the instrument. The cathode-ray tube circuitry provides the necessary controls and adjustments for presenting a sharp display of the desired intensity for displaying the signals applied to the deflection plates by the plug-in modules.

The voltage calibrator yields a 1-volt, peak-to-peak fast rise and fall time square wave signal for use in normalizing the gain of the plug-in amplifier modules and for setting the timing of the time base plug-in module wherever the power-line frequency is a controlled standard.

2-3. POWER REQUIREMENTS

The line transformer in this oscilloscope can be set for either 115-volt or 230-volt operation; a plate on the rear of the instrument specifies the voltage for which your instrument is set. If the instrument is set for 115-volt operation, it will operate properly at any line voltage between 105 and 125 volts. If it is set for 230-volt operation, it will operate properly at any line voltage between 210 and 250 volts. Line voltages beyond the limit specified may cause the power supplies to go out of regulation. Power-line voltage excursion will be more limited over the permissible power-line frequency range of 48 to 1000 cycles. Harmonic distortion should not exceed 5%.

If desired, this instrument can be converted from 115-volt operation to 230-volt operation, or vice versa, by merely setting the 115V/230V Selector switch to the desired voltage.

Although primarily designed to operate at a line frequency between 50 and 60 cycles, this instrument can be operated at any line frequency from 48 cycles to 1000 cycles. However, slightly higher line voltages are required at the higher frequencies.

2-4. OPERATING INSTRUCTIONS (Figures 2-1 and 2-2)

Any of the plug-in modules may be inserted in either of the cavities in the front of the instrument. The module on the right, controls the horizontal deflection of the beam, and the module on the left, controls the vertical deflection of the beam. Thus, it is possible to change from a horizontal time sweep to a vertical time sweep merely by changing the position of a time-base module. However, there is no provision for coupling an unblanking pulse from the left-hand module to the cathode-ray tube, so when a vertical sweep is used, the trace is not blanked between sweeps. X-Y operation is obtained by using amplifier modules in both oscilloscope cavities. (The right-hand cavity is often referred to in the plug-in manuals as the "X-Axis" cavity; the left-hand cavity is referred to as the "Y-Axis" cavity.) The procedure for making the adjustment on each plug-in is described in its individual manual.

The following illustrations are designed to aid the operator in becoming familiar with the oscilloscope.

Figure 2-1. Type 766H Solid State Oscilloscope, Front-Panel Facilities

Figure 2-2. Type 766H Calibrator Display

We know that you are anxious to get acquainted with your new instrument. To aid you in this endeavor, you may set up the instrument using the built-in calibrator signal to demonstrate the effects of the various controls on the display.

Intensity modulation of the CRT beam is possible through the Z INPUT connector at the rear of the oscilloscope.

INTENSITY

Control: varies trace brightness

SCALE ILLUM

Control with switch: dimmer control varies scale illumination; attached switch turns power on or off

FOCUS

Control: provides an adjustable voltage for cathode-ray tube focus grid to optimize spot size

ASTIG

Control: provides an adjustable voltage for cathode-ray tube to optimize spot shape

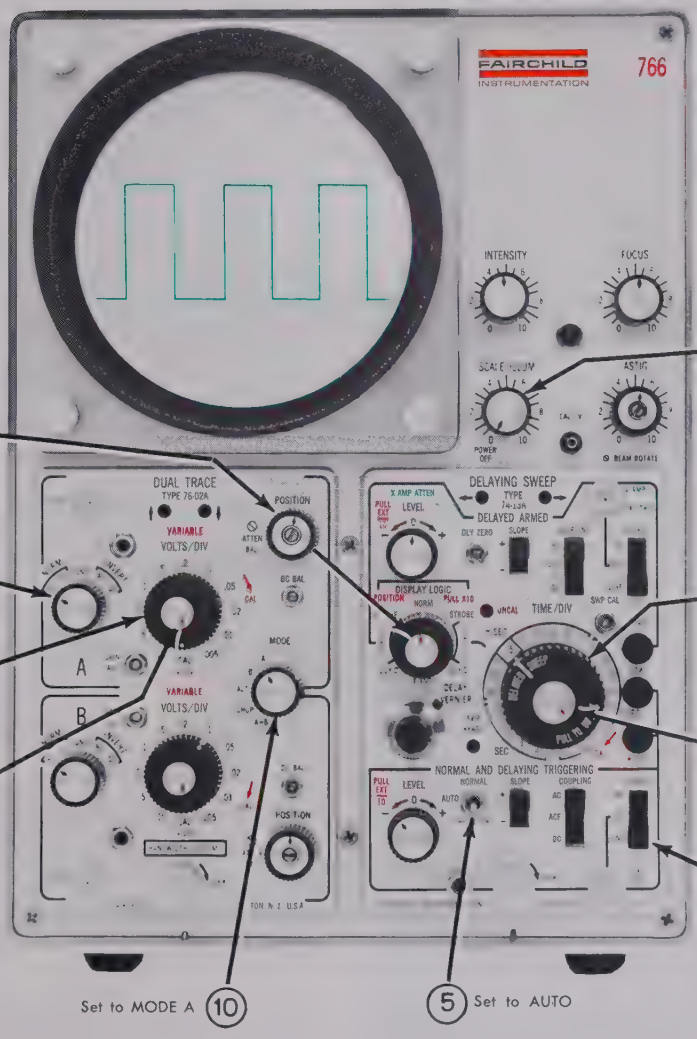
BEAM ROTATE

Concentric screwdriver control: varies the field strength which the CRT beam intercepts causing it to rotate, thus compensating for the earth's magnetic effect on trace alignment

Figure 2-1. Type 766 Solid State Oscilloscope, Front Panel Facilities

To obtain the calibrator display, set the controls exactly as shown and perform the numbered steps in sequence.

Use the same procedure when difficulty is experienced when obtaining a display. This will eliminate "cockpit" troubles due to misalignment of controls.



Set ASTIG, FOCUS, & INTENSITY controls to center of range

Readjust INTENSITY, FOCUS and ASTIG controls for a sharp pattern. Readjust 6 to center the display

1 Rotate clockwise to turn on the oscilloscope

Set POSITION controls to center of range 6

Set to NORM AC 7

Set outer knob (VOLTS/DIV) to CAL 8

Rotate inner knob (VARIABLE) fully clockwise 9

2 Set both TIME/DIV "clutched knobs" to 5 mSEC

3 Set VERNIER fully clockwise

4 Set switches to: +, AC, & LINE

Set to MODE A 10

5 Set to AUTO

Set outer knob (MODE) to CH 1

Figure 2-2. Type 766 Calibrator Display

To remove a plug-in from the Main Frame, simply unscrew the knurled thumbscrew at center bottom of unit and pull it free of the Main Frame. The plug-in unit is provided with a power-line interlock jumper on its connector, hence all power is automatically disconnected whenever a plug-in is removed.

When you change a module from one cavity of the Indicator Unit to the other, you must adjust the gain of the plug-in unit to allow for the difference in vertical and horizontal sensitivity of the cathode-ray tube. This is accomplished by means of the GAIN ADJ or SWP CAL front-panel screwdriver controls on the plug-in modules and permits normalization of the plug-ins to any Main Frame.

The Type 76-00 Series plug-ins have a GAIN CAL range in the order of 3 to 1 so that in general they can be calibrated to the scale markings in either the Y or X cavity.

All Type 74-00 Series Amplifier plug-ins can be calibrated to the scale markings in either the Y or X cavity.

The Type 74-00 Series Sweep plug-ins have a calibration range of approximately ±25% to adjust for variations in X sensitivity of individual Main Frames. When inserted in the Y cavity, these plug-ins can only be calibrated to twice their normal sweep rate.

2-5. BEAM BRIGHTENING FACILITY (Figure 2-3)

A back-of-panel slide switch labeled BEAM BRIGHTENING is provided on all of the high-voltage and the high-frequency Main Frame models so that both NORMAL (beam gate blanking) and FAST SINGLE SWEEP ONLY (grid-cathode blanking) are available. See Figure 5-6 for location of switch.

Beam brightening is normally accomplished by applying the unblanking pulse to the CRT beam gating plates. To record high-speed transients, it is necessary to unblank or brighten the CRT beam with an AC coupled negative gate applied to the cathode of the CRT. Cathode drive for beam brightening is desirable when high writing rates are required to assure maximum beam current with minimum spot size.

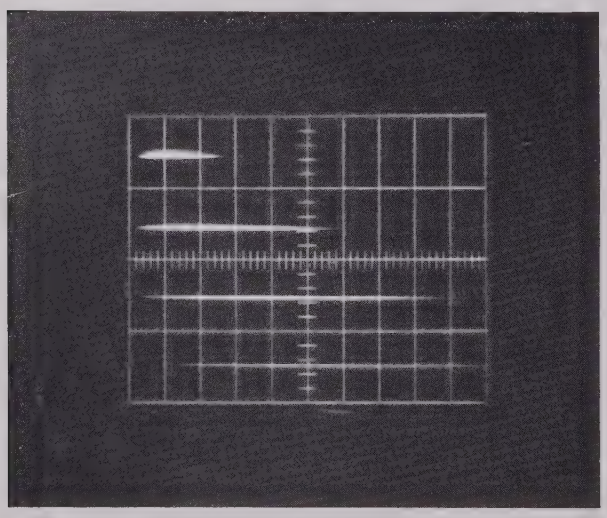


Figure 2-3. Single Sweep Unblanking vs Sweep Speed

Basically, the beam brightening feature should not be used except on fast sweeps, because in the single shot mode, the brightening gate is ac coupled to the cathode of the CRT. This means that if slow sweep speeds are used, full scan unblanking may not be available since the brightening gate will be differentiated by the capacitive-resistive coupling network.

Figure 2-3 shows the effect of the AC coupled beam brightening pulse. The Time Base unit was set up for single sweep and for sweep rates of 50 μsec, 20 μsec, 10 μsec, and 5 μsec respectively. Judging from Figure 2-3, it may be seen that the beam brightening is only effective at very fast sweep speeds. This effect offers no real disadvantage since the purpose of the Single Shot mode is to photograph fast transients. By setting the BEAM BRIGHTENING switch to NORMAL, the unit may be operated as a standard oscilloscope.

2-6. OPERATOR'S MAINTENANCE INFORMATION

Frequently, many oscilloscope ailments may be discovered through an erroneous display on the screen or by the conspicuous absence of a display. The information in the paragraphs to follow will pin-point this information according to the symptoms presented to the operator.

a. A Naked Screen

If the operator is not able to obtain a trace or spot on the screen for either beam after substituting other plug-ins known to be operating properly, the trouble is confined to the Indicator or Main Frame Unit. Refer to Section 5 of this manual for diagnostic and remedial procedures.

b. Insufficient Deflection

If the horizontal or vertical deflection signal cannot be set to the proper value with the front-panel screwdriver controls GAIN ADJ or SWP CAL on the plug-ins, then check the output of the low-voltage regulated supplies at Test Points TP1001, TP1101, TP1201, and TP1301 located on the Main Frame. The high-voltage Test Point is TP2001 also located on the Main Frame chassis. If these voltages check out alright, the trouble may reside in one of the plug-ins. If there is insufficient vertical deflection, it is in the left-hand module; if there is insufficient horizontal deflection, it is in the right-hand module. Refer to the appropriate plug-in module Instruction Manual for further information.

c. Improper Sweep Timing

A front-panel screwdriver control, SWP CAL, is provided on the Time Base Plug-in to permit normalization of this module to any main frame. If this control does not have sufficient range, then check the output of the regulated supplies at the Test Points previously mentioned. If these voltages are normal, then check out the Time Base Plug-in.

d. Improper Triggering

If external and line triggering modes are satisfactory, but the internal triggering mode is not, then the trouble may reside in the trigger take-off circuit of the Y Plug-in amplifier that the operator is using. However, if improper triggering cannot be obtained from any of the triggering sources, the trouble probably resides in the Time Base Plug-in itself. Refer to the Time Base Plug-in Instruction Manual for more information.

e. Waveform Distortion

If the display under observation is distorted, but there is no other manifestation of trouble such as insufficient deflection, improper sweep rate etc., then the problem is confined to the plug-in which is amplifying the distorted signal. Check that the PATTERN POSITIONING control is properly adjusted.

NOTES

SECTION 3
CIRCUIT DESCRIPTION

3-1. INTRODUCTION

This section of the Instruction Manual contains the circuit description of the Main Frame or Indicator Unit alone. The circuit description will be keyed to the Functional Block Diagrams, Figures 3-1 and 3-2. Emphasis is placed on the interrelation of circuits rather than on detail of operation. It is also recommended that the schematics at the rear of this manual be referred to in following the circuit description.

3-2. CIRCUIT DESCRIPTION FOR LOW VOLTAGE REGULATED SUPPLIES (Figures 3-1 and 3-2)

a. Power Transformer

Low voltage and heater power for this instrument is provided by power transformer T1001. The primary is wound with two equal 115-volt windings that can be switched either in parallel for 115-volt operation, or in series for 230-volt operation via the 115V/230V Selector switch S100. The secondaries contain four separate windings which provide power to the regulated supplies and two separate heater windings.

b. Regulated Supplies

Four regulated and two unregulated supplies are provided with output as shown in Figures 3-1 and 3-2, Functional Block Diagrams of the Power Supply. All of the regulated supplies are of the constant-output voltage series-passing type.

The basic reference for all of the regulated supplies is established by the fixed drop across zener diode CR1304. This constant drop or reference voltage is applied to the base of Q1302 which is one of the inputs to differential amplifier Q1301 and Q1302. The other input to the amplifier is connected across a divider consisting of R1302 through R1305 which samples a portion of the −50V regulated output.

A portion of this sample voltage is tapped by the −50V ADJ potentiometer R1303, and is applied to the base of Q1301. Potentiometer R1303 is adjusted so that the output is precisely −50 volts. The minus 50-volt output is also the voltage reference source for the other low-voltage regulated supplies. Thus, voltage adjustments are always made in the sequence starting with the −50-volt supply and ending with the +200-volt supply.

Since the operation of the low-voltage regulated supplies is similar, only the +50-volt supply is described. CR1201 and CR1202 are connected in a conventional full-wave rectifier circuit. The rectified output is capacitively filtered by C1201 shunted by resistor R1202 and applied to the voltage regulator.

Operation of the regulator is as follows: assume the output voltage tends to decrease. This will lower the base voltage of the error detector dc amplifier Q1201, and raise the base voltage of emitter follower driver Q1202.

The increase in voltage at the emitter of Q1202 is applied to the base of the series-passing transistor Q1203. The resultant increase in voltage at the emitter of the pass transistor is such as to return the output voltage to its proper value.

c. Voltage Calibrator

The power-line frequency voltage from T1001 is applied to the base of the voltage calibrator Q1051 through limiting resistor R1051. Negative and positive voltage excursions will drive the transistor into and out of conduction at the line-frequency rate. The resulting square wave is applied to a voltage divider consisting of R1053 and R1054. The attenuated calibrator output of one volt peak-to-peak is coupled to the amplifier plug-in when the VOLTS/DIV switch is set to CAL. The plus 100-volt supply and the saturation voltage of the transistor will determine the peak-to-peak voltage excursion of the calibrator waveform.

3-3. CRT CIRCUIT

a. CRT Beam Control Circuits

The INTENSITY control R2016, part of the negative high-voltage divider is used to vary the cathode-ray tube grid voltage to adjust the beam current. The FOCUS control R2014 is provided to vary the voltage at the focusing anode to set the second cross-over point right at the screen of the cathode-ray tube. The ASTIGmatism control R2022F is provided to vary the voltage at the astigmatism anodes to focus the spot in both axes simultaneously. The PATTERN CORRection service adjustment is set to vary the field the cathode-ray beam encounters as it emerges from the deflection system to control the linearity at the extremes of deflection.

The BEAM ROTATE front-panel screwdriver control R2022 is provided to vary the current through coil L2001 around the neck of the CRT. The current varies the field strength which the CRT beam intercepts causing it to rotate. This function is used to compensate for the earth's magnetic effect on trace alignment.

b. High Voltage Power Supply

Accelerating voltages for the cathode-ray tube are obtained by rectifying a 30-Kc high voltage produced

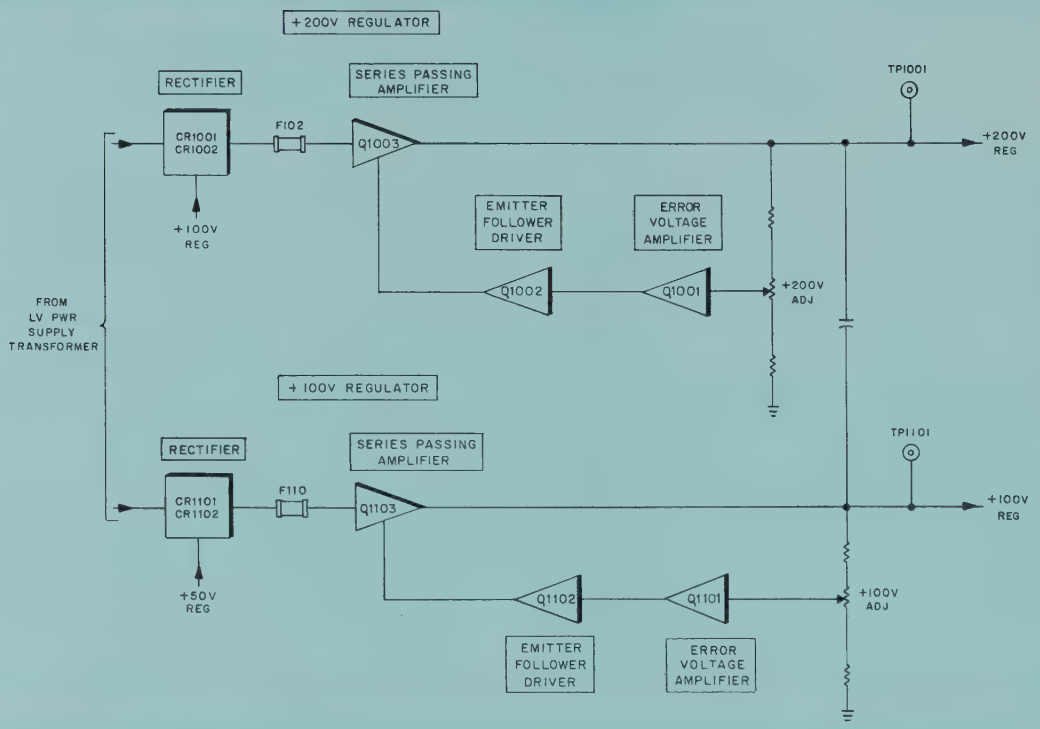


Figure 3-1. +200V and +100V Regulators, Functional Block Diagram

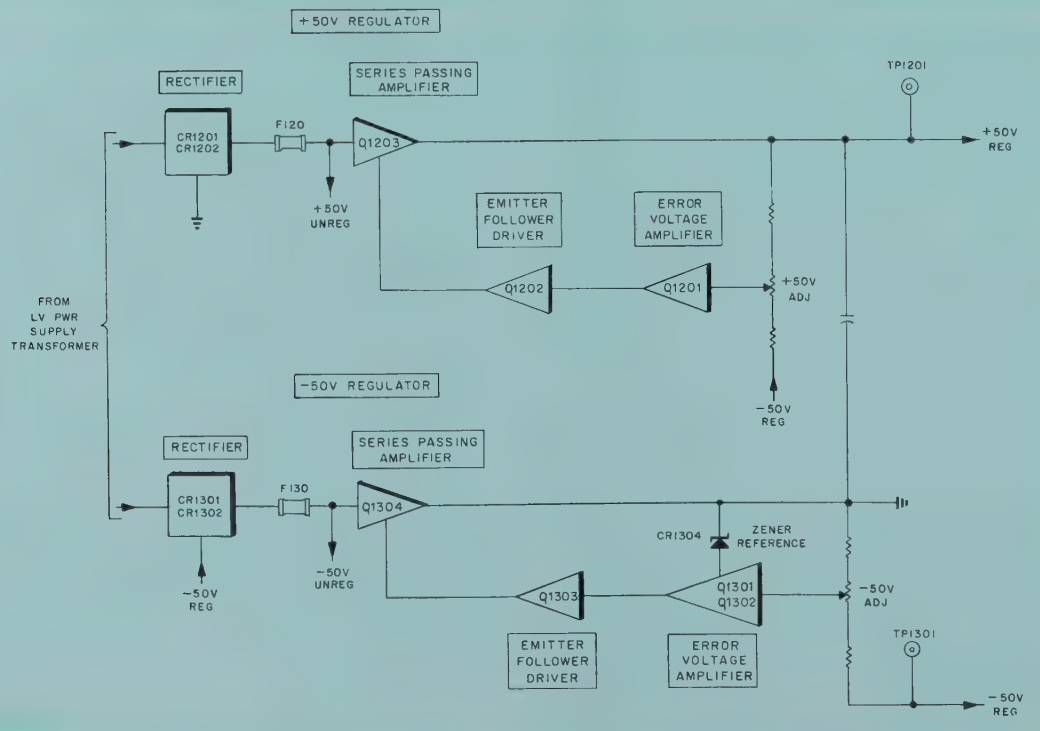


Figure 3-2. +50V and −50V Regulators, Functional Block Diagram

by transistor oscillator Q2002. This transistor is connected as a Class C oscillator with the primary of transformer T2001 tuned by the strayed capacitance and the reflected secondary impedance.

The output of the oscillator is stepped up by T2001 and applied via a conventional solid state tripler network consisting of CR2050 through CR2052 to the post-deflection accelerator of the cathode-ray tube.

The negative high-voltage supply is derived from a tap on the secondary winding of transformer T2001 which is connected to a half-wave rectifier CR2001. The rectified output of −1440 volts is capacitively filtered by C2008, C2009, and C2011 and provides the necessary operating potentials for the proper intensity and focusing of the cathode-ray tube.

Regulation of the high voltage negative supply is accomplished by sampling a portion of the rectified output and applying a correction signal back through the HV regulator Q2000 to Q2002 to the base of the HV oscillator Q2003. This action changes the amplitude of oscillation of Q2003 and T2001 in such a manner as to restore the high voltage output to its preset level. Potentiometer R2009R, HV ADJ, is provided to preset the output of the high-voltage supply to its proper level.

3-4. NORMAL SWEEP UNBLANKING

The cathode-ray tube used in this oscilloscope has two additional beam deflection plates which cut off the electron beam independently of the control grid. In beam gate blanking, the electron beam is always turned on and passes through an aperture in the center of a blanking shield. Behind this shield is a set of deflection plates, one of which is connected to a fixed +50 volt source, while the second deflection plate is connected to the unblanking gate from the X Plug-in. When the time base is sweeping, both beam gate deflection plates are at the same potential and the electron beam passes through the aperture in the blanking shield. When the sweep ends and the unblanking gate voltage increases, the beam is deflected behind the blanking plate and the screen is dark.

Beam control pulses (trace brightening and retrace blanking pulses) can easily be dc coupled since these beam deflection plates are electrically close to ground. Hence, the display is visible only during the forward sweep interval and is blanked during the retrace and lockout interval.

3-5. FAST SINGLE SWEEP UNBLANKING

A back-of-panel slide switch is provided on the high-voltage and high-frequency Main Frame models so that both NORMAL (beam gate blanking) and SINGLE SHOT (grid-cathode blanking) are available. Cathode drive for beam brightening is desirable when high writing rates are required to assure maximum beam current with minimum spot size.

When it is desired to record high-speed, single-shot transients, the back-of-panel Beam Brightening switch is set to FAST SINGLE SWEEP ONLY. This technique completely turns off the electron beam eliminating the possibility of film fogging and loss of information when the lens is open for an extended period.

NOTES

SECTION 4
PERFORMANCE ASSURANCE TEST

4-1. MAINTENANCE CHECK TO ASSURE PERFORMANCE

The tests described in the paragraphs to follow should be performed by Instrument Test Departments and Maintenance Laboratories to certify proper performance of this instrument. These tests are divided into sections for simplification and to assist those test groups where complete checking is not mandatory, or where all test equipment is not available. Refer to Section 5, paragraph 5-7, for list of test equipment required.

NOTE

If this oscilloscope is checked by a Receiving Inspection laboratory, the tests outlined below are recommended to certify performance. This instrument has been thoroughly tested and aged at the factory. Nevertheless, rough shipment, extreme environments, or long idle periods may necessitate minor adjustments of the controls. Hence, it is suggested that the certifying engineer try the recommended adjustments not only for recentering the controls, but also to ascertain their range and to familiarize himself with this precision instrument. If, after performing all the tests outlined in the paragraphs to follow, the instrument will not perform to specification, the assistance of the local Fairchild Field Engineering representative should be requested.

4-2. CHECKING THE POWER SUPPLY

1. Check the line fuse(s) F101 for proper value: 3 amperes; an additional line fuse is provided in the "M" models: F150, 2 amperes.

2. Check fuses of the regulated supplies for proper value:

Regulated Supply	Symbol	Fuse Rating
−50 volts	F130	1 ampere
+50 volts	F120	1.5 amperes
+100 volts	F110	1 ampere
+200 volts	F102	0.5 ampere
Line	F101	3A SLO BLD

3. Examine the instrument for charred or mechanically damaged components. Correct all defects.

4. Apply power to the instrument through a variable voltage source (Variac, or an equivalent). Set the line voltage to 115 volts. (Double this value for 230-volt operation.)

5. Set up the oscilloscope to obtain six cycles of the calibrator signal.

6. Allow 20 minutes for warmup before making any adjustments.

7. Lower the line voltage to 105 volts (210 volts for 230-volt operation). The display should remain stable and must not be erratic. If instability is noted before the lower limit of the line voltage is reached, check operation of the low-voltage regulated power supplies as outlined in Section 5 of this Instruction Manual.

Note: Always check the regulated voltages starting with the −50-volt supply and ending with the +200-volt supply.

8. Raise the line voltage to 125 volts (250 volts for 230-volt operation). The display should remain stable and must not be erratic. If instability is noted before this upper limit of line voltage is reached, check operation of the low-voltage power supplies.

9. Reset the line voltage to 115 volts (230 volts for 230-volt operation).

4-3. CHECK RIPPLE OF LOW-VOLTAGE SUPPLIES

1. Use a Type 704 Test Oscilloscope with a Type 4290 Probe.

2. Ground all chassis to power-line ground.

3. Set the oscilloscope for ac coupled input and set Y sensitivity to 5 mv/cm.

4. Use AUTO triggering with line sync and set SWEEP RATE switch to 5 mS/CM.

5. Measure the amount of 120-cycle ripple at the output of each power supply as listed below. (For line frequencies other than 60 cycles, the ripple will be twice the line frequency.)

Regulated Supply	Ripple Voltage	Test Point
−50 volts	10 millivolts p-p max	TP1301
+50 volts	20 millivolts p-p max	TP1201
+100 volts	30 millivolts p-p max	TP1101
+200 volts	65 millivolts p-p max	TP1001

4-4. CALIBRATOR CHECK

a. Waveshape Check

1. Adjust the Type 704 Oscilloscope for a sensitivity of 20 mv/cm and connect the Y INPUT to the CAL pin jack on the front panel of the Main Frame via the Type 4290 Attenuator Probe.

2. Observe a 1 volt (5 cm) peak-to-peak, 60-cycle square wave; rise time to be less than 20 μsec. Tilt and ringing should be less than 5% (50 mv or 2.5 mm).

b. Amplitude Accuracy (Optional Test)

Note: This check is not required on every oscilloscope.

1. Precisely calibrate the Type 704 Oscilloscope with the Ballantine Model 420 Calibrator. The oscilloscope is set up with the Type 4290 Probe at a sensitivity of 20 mv/cm.

2. Set the Ballantine Calibrator for a frequency of 1 Kc at an output of 1 volt peak.

3. Adjust oscilloscope for 5-centimeter vertical bar.

4. Transfer the Probe from the Ballantine Calibrator to the 1 volt pin jack. Note Calibrator amplitude to be 4.9 to 5.1 cm (1 volt ±2%). Avoid errors by using the anti-parallax scale.

4-5. CHECKING CRT GEOMETRY ADJUSTMENT

Set Y VOLTS/DIV switches to CAL and SWEEP RATE switches to 5 mS/DIV. Note the steady square wave patterns on the screen for each beam. The display should fall within a 6 cm x 10 cm and a 5.75 cm x 9.75 cm frame. Refer to the paragraph entitled "CRT Adjustments," in Section 5 of this Instruction Manual for further details.

SECTION 5
MAINTENANCE AND RECALIBRATION

5-1. INTRODUCTION (Figure 5-1)

This section of the Instruction Manual contains service information and procedures for internal adjustments. Refer to Figure 5-1 for an over-all functional block diagram of the Type 766H system.

WARNING

WHEN THE COVERS ARE REMOVED FROM THE INSTRUMENT FOR SERVICING, EXERCISE CAUTION WHILE THE POWER IS ON.

To gain access to the chassis for service, remove the side and rear covers. This will expose all of the transistors and service adjustments for normal maintenance.

5-2. REMOVAL AND REPLACEMENT OF PARTS

If it is necessary to order a replacement component from the factory, always give the Type Number and Serial Number of the instrument. Before ordering parts for in-warranty replacement or purchasing them for out-of-warranty replacement, be sure to consult the Parts List in this manual. The Parts List gives the values, tolerances, ratings, and the factory part number for all electrical components used in the instrument. This will help to expedite service.

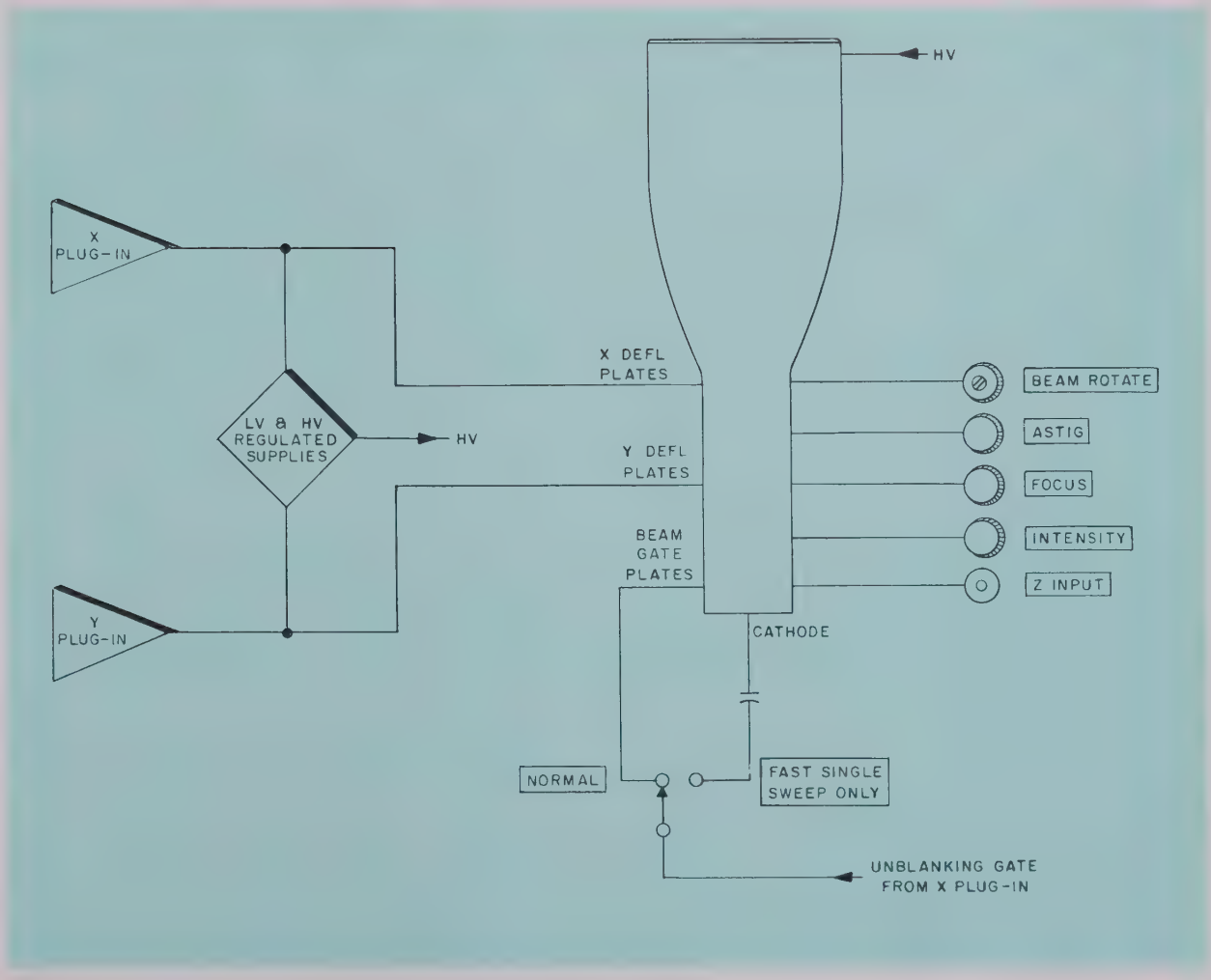


Figure 5-1. Over-all System Functional Block Diagram

Since your instrument left the factory, some of the parts may have been superseded by improved components. In such cases, the part numbers of these new components will not be listed in your Parts List. However, if you order a part from the factory and it has been superseded by an improved component, the new part will be shipped in place of the part ordered.

It is the aim of the Fairchild organization to make available the most reliable commercial oscilloscopes within the state of the art and to provide services which will help the user to rapidly restore any of our equipment to its specified performance. Your local Field representative maintains a limited number of spare parts. Also, the factory may be asked to airship replacement parts on a rush basis.

The procedure for replacing most parts in this instrument is obvious, therefore specific instructions for their removal are not required.

Note: Be sure and replace the beryllium oxide insulating washers (they serve as heat sinks) on the transistors that require them. Always grease these heat sinks with Dow Corning silicone grease for optimum heat transfer.

5-3. CATHODE-RAY TUBE REPLACEMENT

CAUTION

THE CATHODE-RAY TUBE SHOULD BE HANDLED WITH GREAT CARE TO PREVENT BREAKAGE AND/OR SERIOUS PERSONAL INJURY FROM FLYING GLASS.

To remove the cathode-ray tube, first remove the covers, disconnect the tube socket, HV anode cap, and the 4 leads connected at the neck of the tube. Remove the bezel and loosen the tube clamp at the base of the CRT. Pull the cathode-ray tube straight out through the front panel. Be careful not to break the neck pins on the CRT as the tube is removed. Install the new cathode-ray tube by the reverse of the foregoing procedure. Be sure to align the scale to the CRT trace and scan aperture.

After the cathode-ray tube has been replaced, it may be necessary to recalibrate. Special attention should be given to recalibration of the time base sweep rates and to the amplifier sensitivities.

5-4. SERVICING HINTS

Although this is a complex electronic instrument, trouble may be localized to the following basic circuits:

1. Low-voltage Power Supply
2. High-voltage Power Supply
3. Cathode-ray Tube Circuit
4. X Plug-in
5. Y Plug-in

Whenever trouble occurs in this instrument, first try to localize it to one of these basic circuits.

There is no simple way of locating troubles. An understanding of the functions of the circuits is the best help. With an understanding of the circuit operation, it will be possible to make a good guess at the general source of troubles from the symptoms. As an aid in trouble shooting this unit, refer to the system block diagram in this Section and also to the schematics.

To keep electronic units operating at top performance, it is desirable to check the equipment at regular intervals. The period between checks will depend on the installation and the conditions of operation. For these regular checks, clean all dust and dirt from the unit using a light air blast or soft brush. However, to insure the reliability of measurements, we suggest that you recalibrate this instrument after each 500 hours of operation or every six months if used intermittently. Also, the calibration of a unit should always be fully checked and adjusted after the repair or replacement of any component in the unit. The complete adjustment procedure for this unit is given in this Section of the Manual.

In the event of improper equipment performance, the following suggestions are recommended:

1. Remove the side and rear covers and inspect for broken wires and faulty components. Check the fuses in each power supply buss. Measure the voltages at the test points in the Main Frame. If all the above are within specifications, the problem will most likely be in the plug-ins. It is suggested that other plug-ins known to be operating properly be inserted on a substitution basis.

2. Whenever an apparent trouble is pin-pointed, make sure that it is not caused by improper setting of the panel controls. For instance, if the TRIGGER COUPLING, SLOPE, or SOURCE controls are improperly set on the Time Base Plug-in, then apparent triggering problems are manifested.

3. When using accessory probes or adapters, be sure the trouble is *not* originating in the accessory before suspecting the oscilloscope itself.

4. When it has been determined that a specific trouble exists and has been localized to a given circuit within a given unit, then make a visual inspection of that circuit. Many troubles, such as loose wires, scorched parts, may be exposed by this method. Obviously you should find and eliminate the cause of charred resistors or over-stressed capacitors before replacing damaged component.

5. Localizing the trouble is made easier by use of an oscilloscope to check waveforms. Use a high-impedance probe while trouble shooting.

6. Sometimes it may be necessary to move the plug-in unit from one cavity to the other in order to gain access to that particular part of the circuit that requires checking. A Type 4294 Extension Cable Acces-

sory is available and permits the plug-in unit to be operated while extended through the front of the oscilloscope.

7. If trouble is isolated to one of the plug-in units, refer to the appropriate module manuals for further information. If the trouble has been definitely isolated to the Main Frame or Indicator, then proceed as follows:

The first step in trouble shooting the Indicator Unit is to measure the power supply voltages at Test Points TP1301, TP1201, TP1101 and TP1001 located on the Main Frame. If all of the voltages are not as indicated, the trouble is in the low-voltage power supply or the power source. To check these, refer to the subsequent paragraph entitled "Trouble Shooting the Power Supply." If all these voltages are proper, the trouble resides in the cathode-ray tube circuit. In this instance, refer to the paragraph entitled "Trouble Shooting the Cathode-Ray Tube Circuit" in this Section of the manual.

5-5. TROUBLE SHOOTING THE POWER SUPPLY

WARNING

WHEN THE COVERS ARE REMOVED FROM THE INSTRUMENT FOR SERVICING, EXERCISE CAUTION WHILE THE POWER IS ON. The lower-voltage busses are potentially more dangerous than the cathode-ray tube potential because of the high-current capabilities and large filter capacitors employed in these supplies. When you reach into the instrument with one hand while it is turned on, do not grasp the metal frame with the other hand. If possible, stand on an insulated floor and use insulated tools. It is advisable to ground the third lead in the power cord whenever the instrument is in use.

As an aid in trouble shooting the power supply, refer to the functional block diagrams Figures 3-1 and 3-2, and to the low-voltage power supply schematic.

1. If the instrument fails to operate, including the pilot light, check the source of power and determine that the power cord is firmly in place. Then check fuses located at the rear of the instrument. (See Figure 5-2.)

Note: Disconnect the power cord when working on the transformer T1001 and associated circuits.

If the fuse is blown, replace it with one of the proper value and reconnect the line cord. If the new fuse blows, immediately check the power transformer for shorted primary or secondary windings. Shorted rectifiers in the secondary circuit will also blow the line fuse F101. Check for an open primary winding of T1001 if the line-fuse is good.

2. A thermal cutout switch is incorporated in this unit. If the instrument has been working but has just stopped, it may have overheated and tripped the thermal cutout switch. The thermal cutout switch will reset itself when the interior temperature of the instrument drops to a safe value. Possible causes of overheating are: restriction of air circulation and high ambient temperature.

3. If the line voltage is within specified limits, and one of the regulated power supply output voltages is not correct, check that particular regulator circuit. Each of the regulated supplies is fused separately. These fuses should be checked and replaced if necessary with a new fuse of the proper value.

Note: Always check the regulated voltages starting with the −50-volt supply and ending with the +200-volt supply.

When the circuit ailment has been confined to a particular regulator, then one may trouble-shoot within this circuit to locate the defective component (s). The description of the circuit involved may prove useful when diagnosing circuit ailments.

4. If none of the regulated voltages are correct, then the trouble probably resides in the −50-volt regulated supply since this voltage serves as a reference level for the other three regulated circuits.

One cause of insufficient output voltage is low unregulated dc voltage which might be caused by an open or shorted rectifier diode.

5. If there is excessive ripple on any of the unregulated supplies, replace the filter capacitor (s).

5-6. TROUBLE SHOOTING THE CRT CIRCUIT

The intensity, focus, geometry, and calibration of the cathode-ray tube display depend on proper operation of the high-voltage supply. To isolate this trouble, remove the rear cover from the Main Frame. Measure the voltage at Test Point TP2001 *using caution.* This voltage reading should be between −1350 volts and −1440 volts with respect to ground. If necessary, adjust the HV ADJ potentiometer R2009R for proper voltage. Remove power and measure the resistance of the primary and secondary windings of high-voltage transformer T2001. The resistance across the primary winding should measure around 5 ohms. Measure the resistance of the secondary winding from the anode of CR2052 to ground; it should measure around 175 ohms.

Also, measure the voltages at other points in the circuit for which typical values are given on the high-voltage power supply schematic. If all of these voltages check out correctly, then the trouble may reside with the cathode-ray tube itself which should be checked.

If the low-voltage power supply is operating normally, but no spot or trace is visible on the screen, then the trouble might be a defective cathode-ray tube, a defect in the CRT circuitry including the high-

voltage supply, an unbalanced condition in either of the plug-in modules, or a defective unblanking circuit.

Note: To obtain a spot or trace on the screen, the cathode-ray tube must be unblanked.

Refer to the appropriate plug-in module Instruction Manual for further information.

5-7. TEST EQUIPMENT REQUIRED FOR SERVICE ADJUSTMENTS

a. Introduction

The adjustments outlined in the following paragraphs are based on the test procedure followed at the factory. All adjustments should be made at mid-line voltage, 115V/230V, ±2%. To set up the Indicator Unit for calibration, insert an amplifier plug-in and a time base plug-in into the Main Frame. These plug-in modules are signal sources for the Main Frame and must be fully tested and certified units. No testing will be performed on the plug-ins for calibration of the Indicator.

b. Test Equipment Required (Equivalent may be substituted)

Equipment	Description
Volt-ohmmeter	— Simpson Model 260 or Triplet Model 630 20,000 ohms/volt sensitivity
Square Wave Generator	— Fairchild Type 791
Oscilloscope	— Fairchild Type 704 with anti-parallax scale (scale #4501 2001)
4290B	— 10:1 Passive Attenuator Probe
High-Voltage Meter	— Sensitive Research Model DCH-1
Autotransformer	— Powerstat, Variac; capable of varying line voltage of the instrument being calibrated
Digital Voltmeter	— Fairchild Type 7100A
AC Voltmeter	— Weston Model 433
Standard Amplitude Calibrator	— Ballantine Type 420
LC Meter	— Tektronix Type 130
Pulse Generator	— Hewlett-Packard Type 8000A
Oscillator	— Hewlett-Packard Type 650A

5-8. ADJUSTING THE LOW-VOLTAGE POWER SUPPLIES

Connect the autotransformer to a suitable power source and connect the oscilloscope to the output of this transformer. Turn on the instrument and set the output for the nominal operating voltage of the oscilloscope (115V for 115-volt operation or 230V for 230-volt operation). Allow the instrument to warm up for about 10 minutes.

Note: Do not adjust the −50-volt supply unless one or more of the supplies is actually out of tolerance or unless a complete calibration of the instrument is desired.

Use a John Fluke Voltmeter and adjust or check the supplies in the sequence and at the Test Points listed.

Regulated Supply	Tolerance	Test Point	Service Adjustment	
−50V	±100 mv	TP1301	R1303	−50V ADJ
+50V	±100 mv	TP1201	R1213	+50V ADJ
+100V	±150 mv	TP1101	R1112	+100V ADJ
+200V	±250 mv	TP1001	R1012	+200V ADJ

Vary the autotransformer output voltage between 105 volts and 125 volts and check to see that all regulated supplies stay within ±1% except the +200 volt supply which is ±1.5%. For 230-volt operation, vary the autotransformer output between 210 volts and 250 volts and check to see that all voltages stay within the above tolerance.

5-9. HIGH-VOLTAGE ADJUSTMENT

Use Sensitive Research High Voltage Meter and Probe with caution.

Apply Probe to the −1350V Test Point TP2001, and adjust R2009R (HV ADJ) for −1350V ±15 volts.

5-10. CRT ADJUSTMENTS

a. Graticule External to CRT

To align the trace to the graticule, proceed as follows:

1. Use recurrent sweep with no signal applied to vertical channel.
2. Set BEAM ROTATE control R2022 to mid-range.
3. Center trace and rotate CRT to match scale.
4. Tighten CRT clamp.

To align the graticule to the scan, proceed as follows:

1. Apply 60-cycle signal to the Y INPUT and adjust oscilloscope for full-screen deflection, one beam at a time.
2. Slow sweep rate to 50 ms/div. Note full raster display on screen.
3. Adjust eccentric cam to assure full 6-division coverage of scale and vertical CRT scan.

Note: This adjustment should only be necessary when the CRT has been removed or replaced. The BEAM ROTATE control should be used for any alignment discrepancies thereafter.

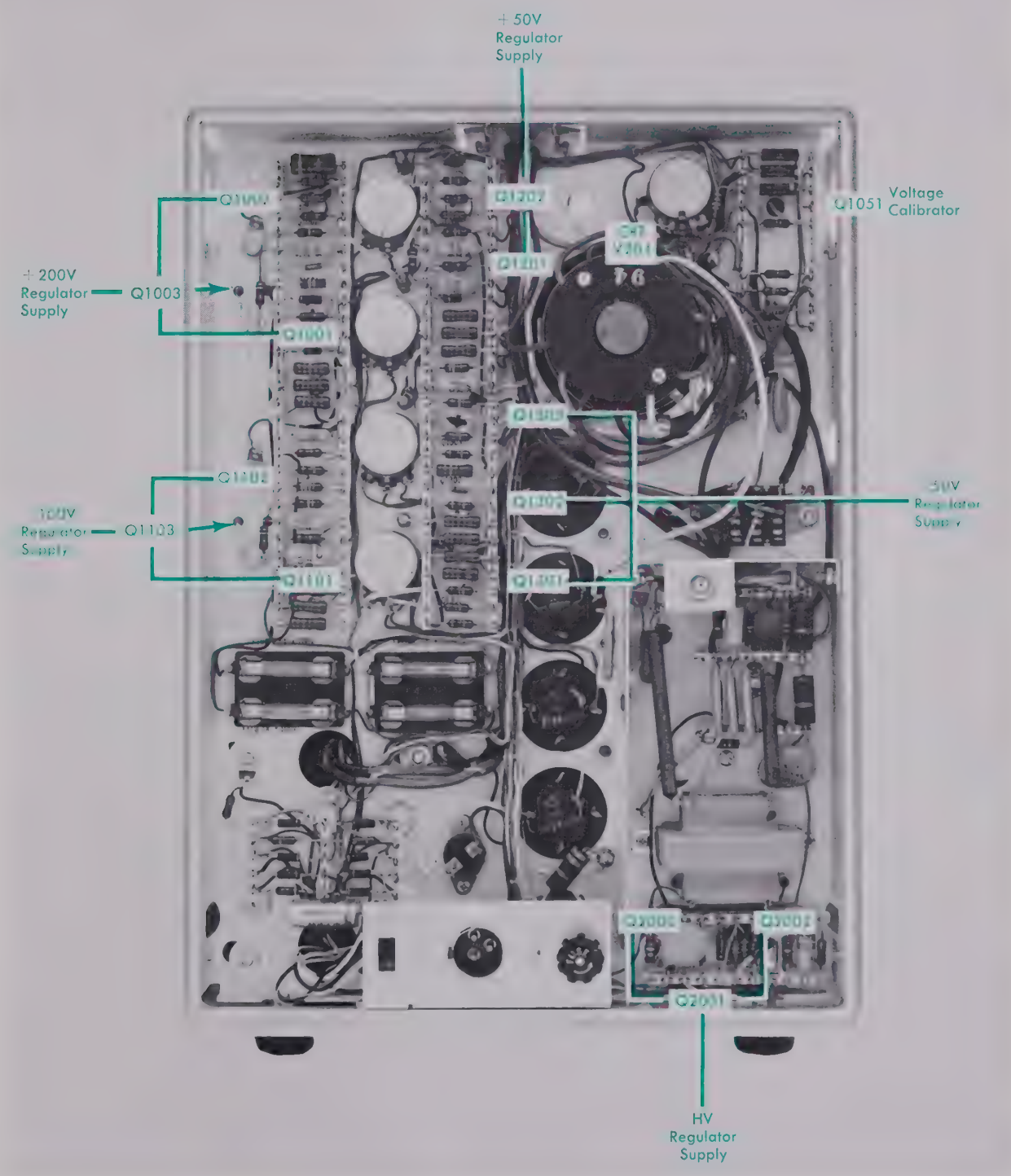


Figure 5-2. Type 766, Rear View Showing Transistors and CRT

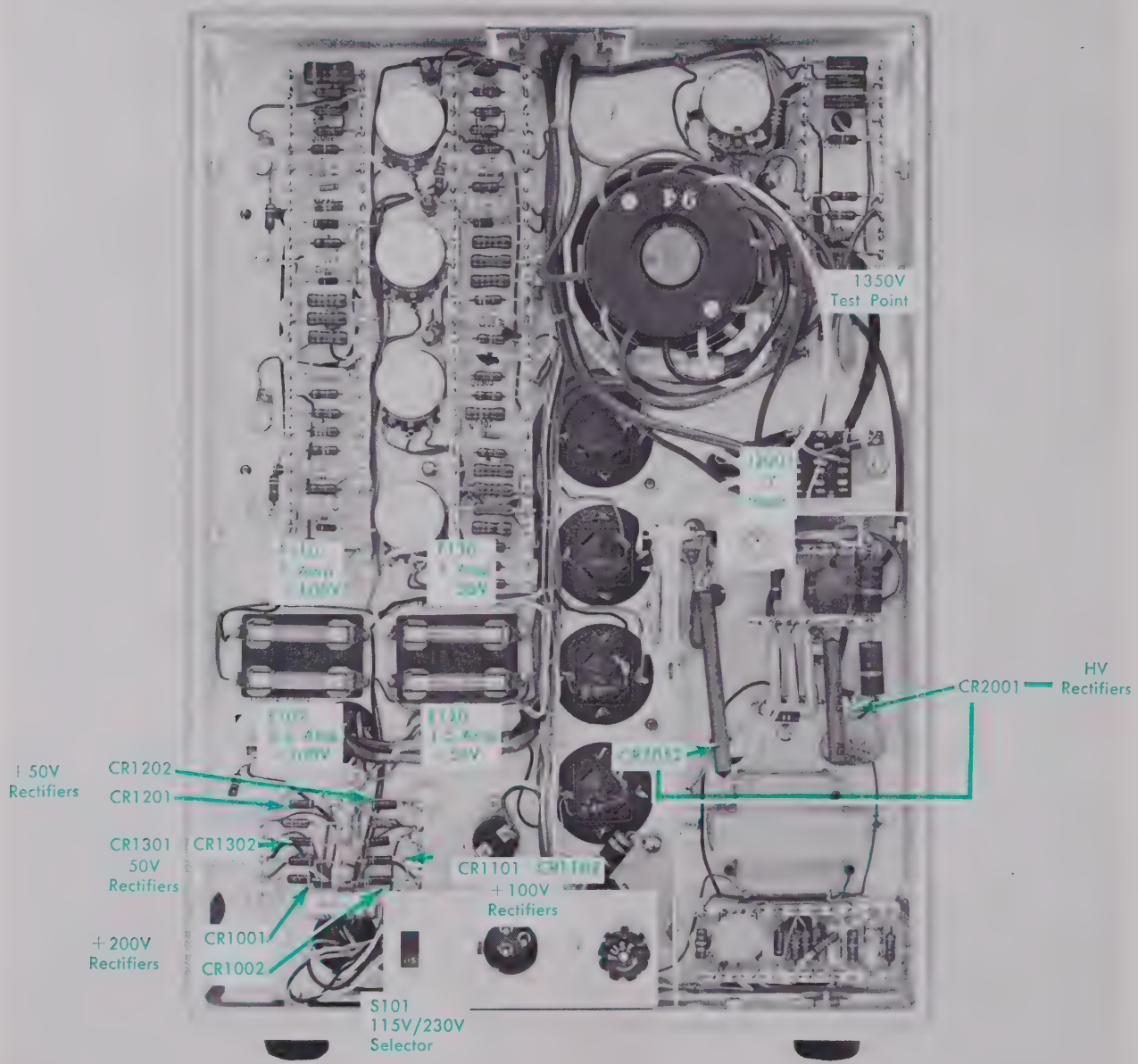


Figure 5-3. Type 766, Rear View Showing Fuses, Switch and Diodes

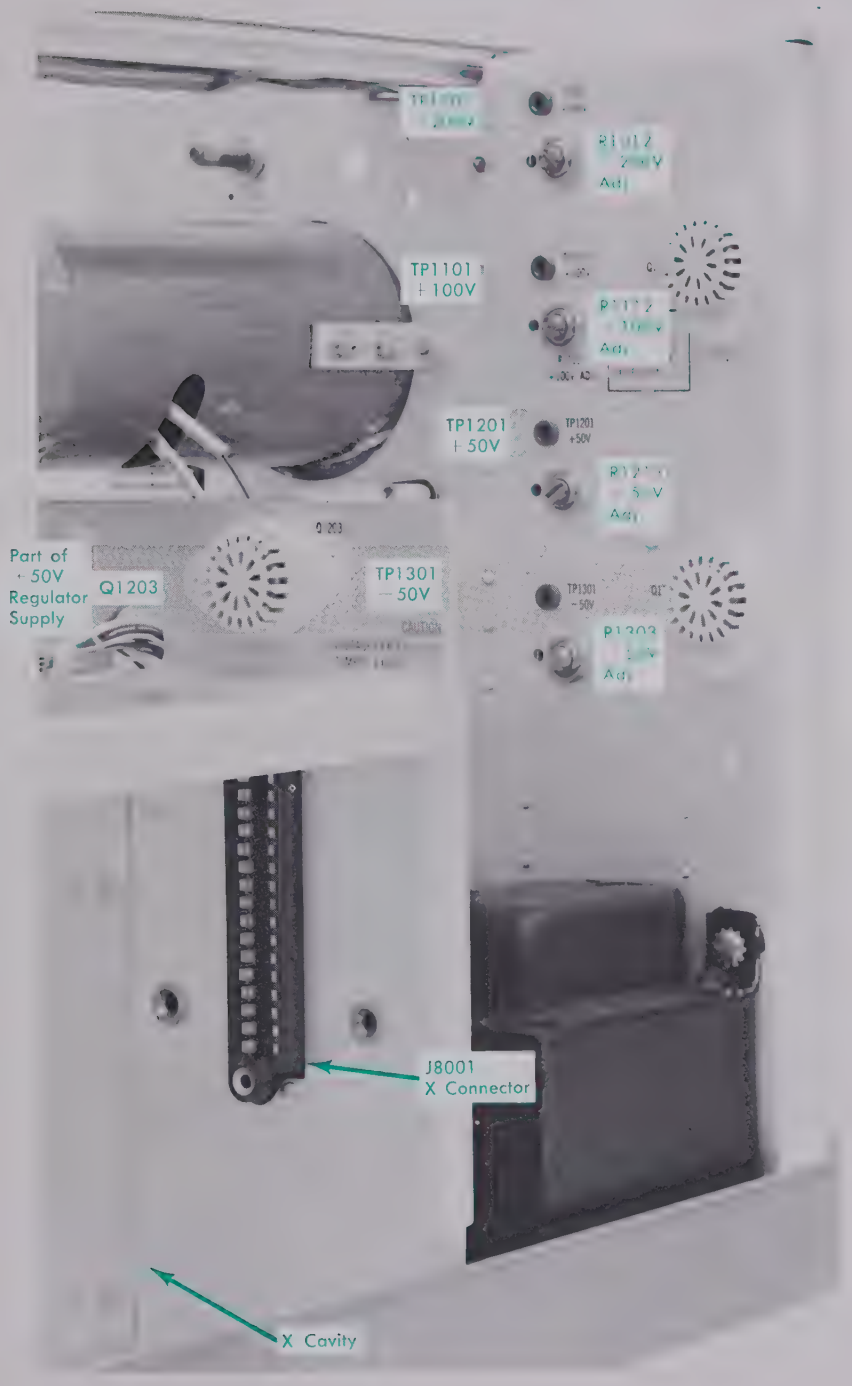


Figure 5-4. Type 766, Top View of Chassis Showing Test Points, Transistors and Adjustments

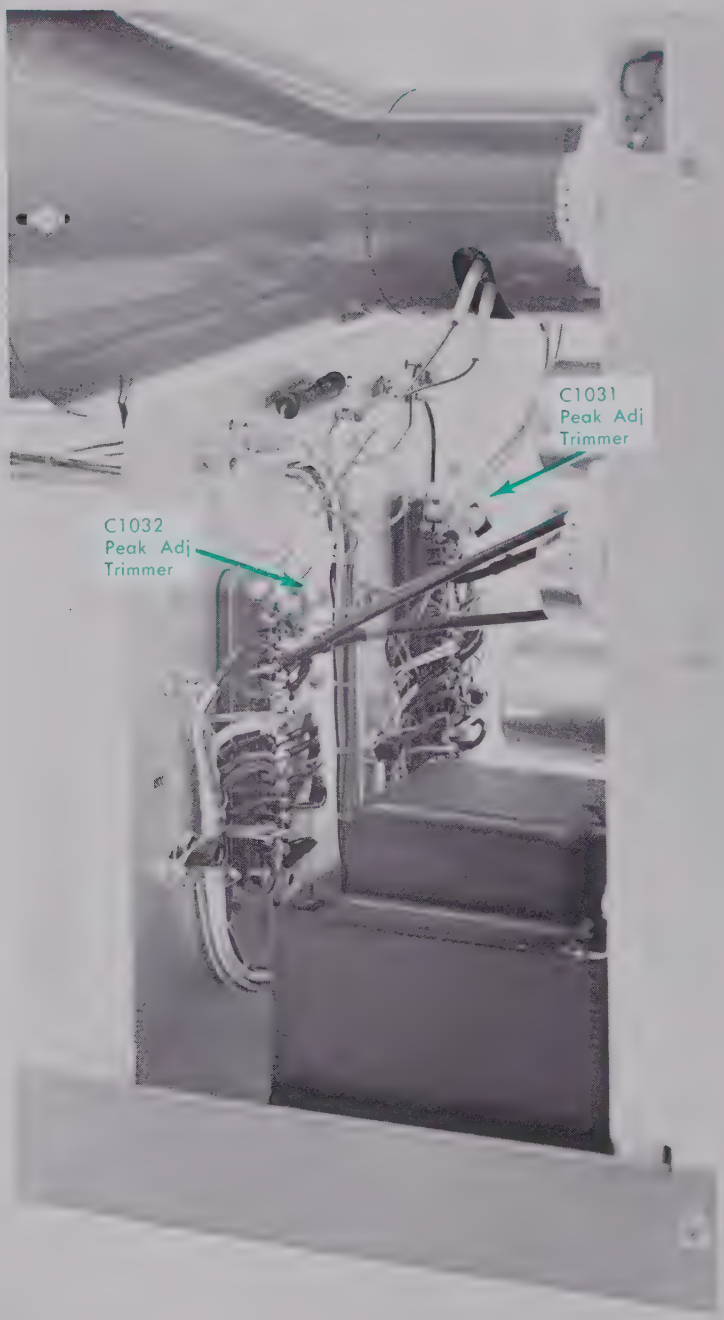


Figure 5-5. Type 766, Right Oblique View Showing X & Y Peaking Trimmers

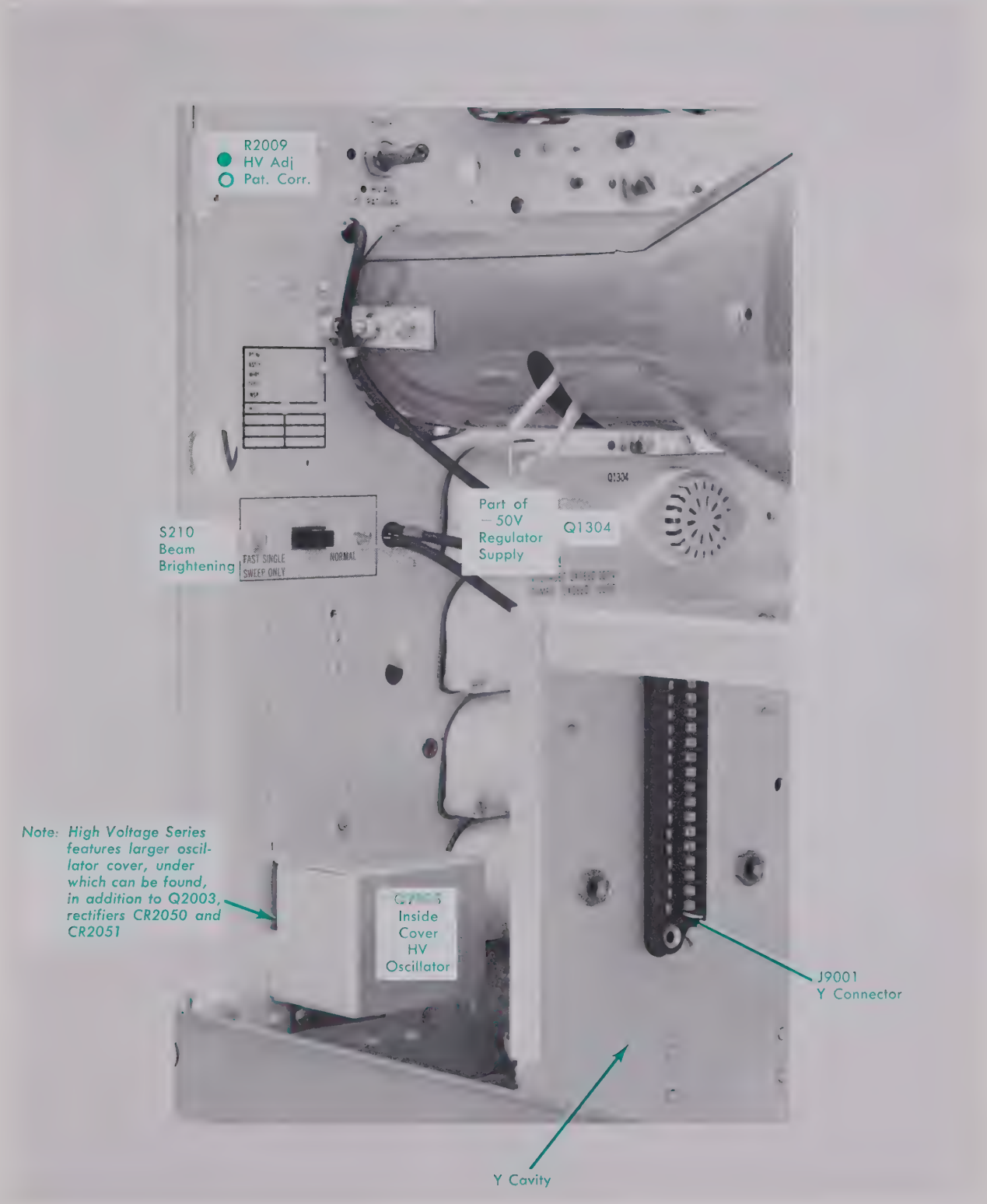


Figure 5-6. Type 766, Left Oblique View Showing Transistors, Switch and Adjustment

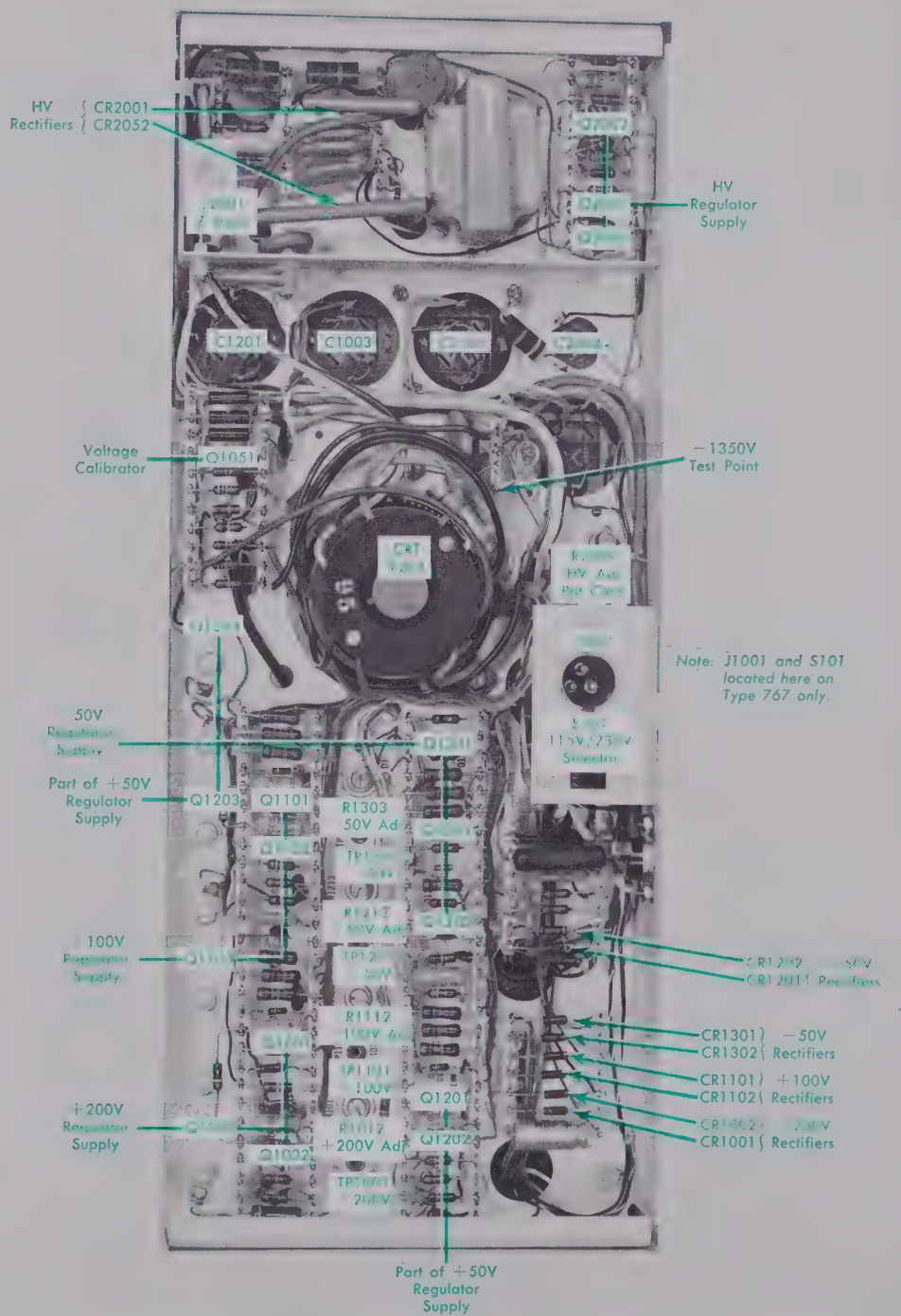


Figure 5-7. Type 765, 767 Component Location (Rear View)

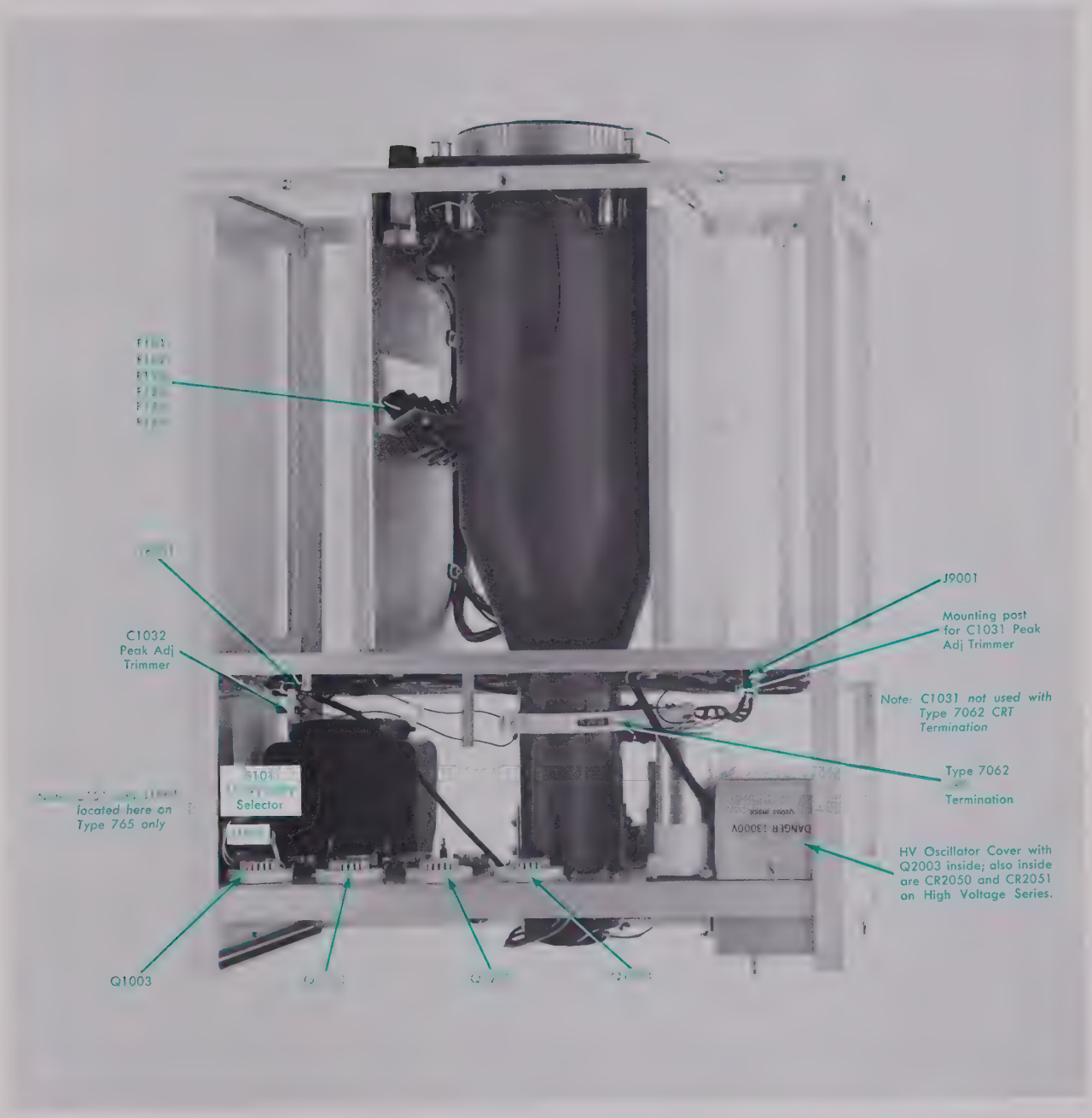

J9001
Mounting post for C1031 Peak Adj Trimmer
C1032 Peak Adj Trimmer
Note: C1031 not used with Type 7062 CRT Termination
Type 7062 Termination
located here on Type 765 only
Selector
HV Oscillator Cover with Q2003 inside; also inside are CR2050 and CR2051 on High Voltage Series.
Q1003

Figure 5-8. Type 765, 767 Component Location (Top View)

b. Graticule Internal to CRT

1. Where the graticule is internal to the CRT, align the tube so that the horizontal center line is perpendicular to the left side of the frame, using a suitable fixture. Clamp CRT.

2. Use recurrent sweep with no signal applied to the vertical channel.

3. Center trace and adjust BEAM ROTATE control R2022 until trace is parallel to horizontal lines of scale.

c. Pattern Correction ADJ

1. Set Y VOLTS/DIV switch to CAL and SWEEP RATE switch to 5 mSEC/DIV. Note steady square wave pattern on screen.

2. Set PATTERN CORRECTION control R2009F, until the vertical and horizontal lines at the 6 x 10 cm edges are optimally straight.

Note: The display should fall within a 6 x 10 cm and a 5.75 x 9.75 cm rectangular frame.

5-11. SETTING MAIN FRAME CAPACITY FOR LV AND HV SERIES ONLY (C1031 and C1032)

a. Introduction

The Low and High Voltage Main Frames are provided with a small trimmer capacitor mounted between pin 1 and pin 17 on the rear of both X and Y axis blue ribbon connectors. The purpose of these capacitors is to standardize the CRT deflection plate capacity between Type 766H Series of Main Frames. The standardization of these capacitors (C1031 and C1032) will allow interchangeability of plug-ins from one Main Frame to another, with a minimum of the high-frequency adjustments on both the X and Y Plug-ins.

b. Adjustment Procedure

1. Select a capacitance meter that can compensate for test lead capacitance of up to 30 pf by means of a zero balance adjustment. The Tektronix Type 130 LC Meter is such an instrument.

2. Remove both plug-in modules, and disconnect the Main Frame power cord. Place the Main Frame and the LC Meter on a non-conductive surface.

3. Fabricate a test cable using one foot of RG-59B/U, UHF connector UG-176/U, and a 32-pin blue-ribbon connector. Attach the UHF connector to one end of the cable, and connect the center conductor and shield at the other end of the cable to blue-ribbon connector pins 1 and 17, respectively.

Note: Any shielded cable can be used, providing its capacitance is low enough to be compensated by the zero adjustments on the LC meter. Do not use clip leads or other temporary connectors as they tend to introduce excessive stray capacitance.

4. Connect the test cable to the UNKNOWN jack on the LC Meter and zero the meter.

5. Plug the test cable blue-ribbon connector into J9001. The LC Meter should read 12.5 pf. If not, adjust C1031 to obtain this reading.

Note: The capacitance value given here (and in step 6) does not represent the actual dynamic input capacitance as seen by the plug-in. This is of little consequence, however, as these measurements are sufficiently repeatable from unit to unit to enable accurate adjustment of the trimmer capacitor.

6. Perform the same measurement at jack J8001. The LC Meter should read 9 pf. If not, adjust C1032 to obtain this reading.

5-12. TYPE 7062 CRT TERMINATION NETWORK (H/F Series Only)

a. Introduction

The Type 7062 CRT Termination Network is "standard equipment" with the High-Frequency Main Frame Oscilloscopes (Types 765H/F, 765MH/F, 766H/F, 766MH/F, 767H/F and 767MH/F). It has been provided to accommodate the Type 79-02A 100 Mc Dual Trace Amplifier.

b. Installation Instructions

The Type 7062 is available as a kit to transform the H models to H/F models. If a Fairchild Type 79-02A is acquired at a later date and the Type 766H Series Oscilloscope has not been modified, then the installation of the Type 7062 CRT Termination Network is mandatory. However, this installation will not affect the operation of any other Fairchild amplifier plug-ins.

See Figures 5-9 and 5-10 for Installation Instructions and Figure 5-11 for the Interconnecting Diagram.

c. Peaking Adjustments (C2053 and R2065) Figure 5-12

1. Hook up Test Equipment as indicated in Figure 5-12.

2. Tack the free end of the twin lead to the input of the Type 7062 Termination.

Note: Do not use alligator clips or other bulky type connectors that will introduce a large capacitive or inductive lump. A small jack such as a tube socket terminal or amphenol connector would be suitable.

3. Set the H.P. Type 8000A Pulse Generator for positive, 0.4-volt pulses on the CRT display.

4. Set R2065 LF PEAKING ADJ to mid-range. A termination bump should appear approximately 25 nanoseconds from the start of the pulse.

5. Adjust HF peaking trimmer C2053 to produce a positive bump 0.2 division in amplitude.

6. Remove Type 79-02A Dual Trace Plug-in, the Type 4294 Extension Cable, and disconnect the long twin lead.

7. Install the Type 7062 with its normal 6¾" length of twin lead.

8. Install a Type 76-08 or other lower frequency amplifier plug-in in the Y cavity.

9. Adjust LF PEAKING ADJ R2065 for flat top.

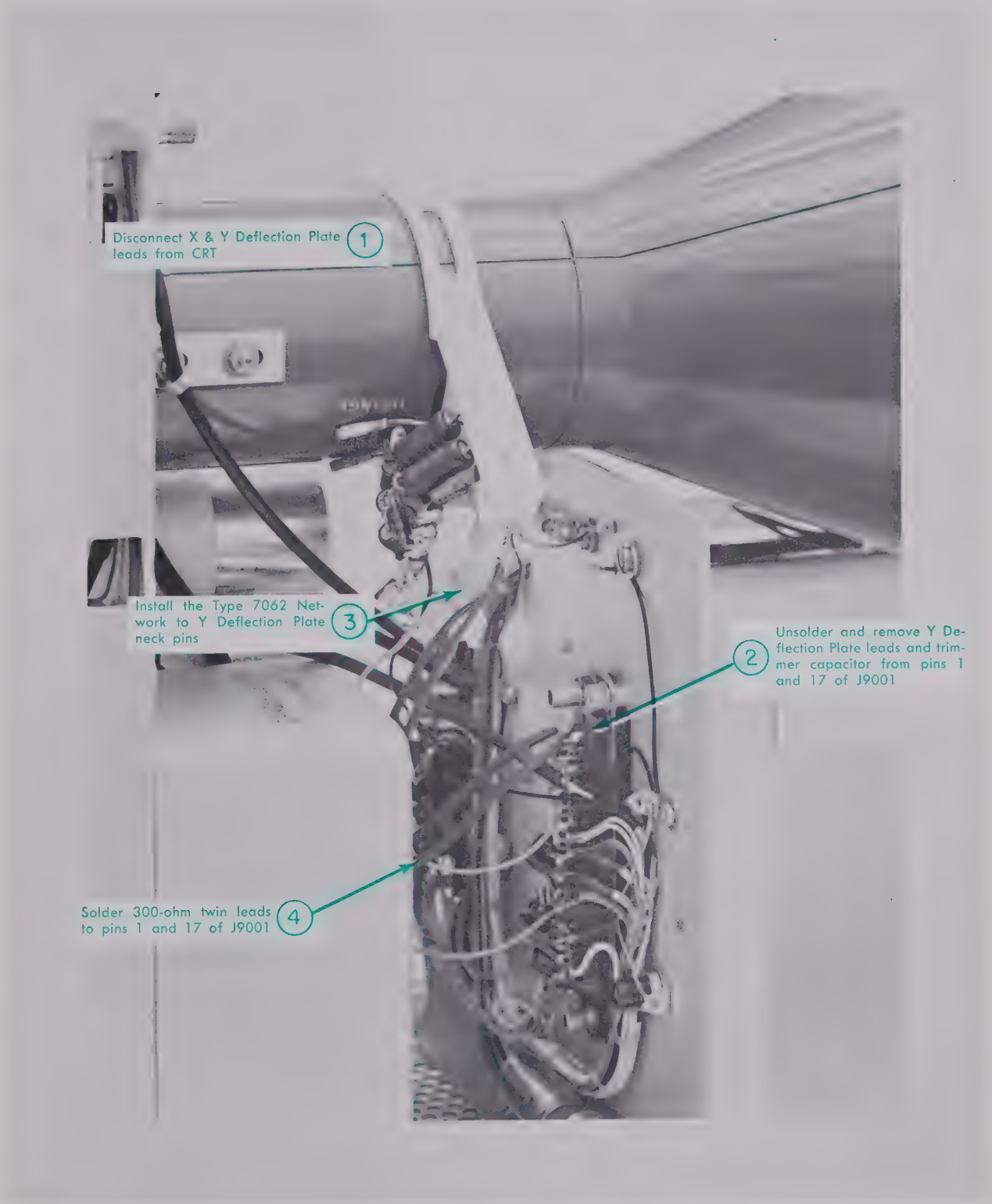

Disconnect X & Y Deflection Plate leads from CRT
1
Install the Type 7062 Network to Y Deflection Plate neck pins
3
Unsolder and remove Y Deflection Plate leads and trimmer capacitor from pins 1 and 17 of J9001
2
Solder 300-ohm twin leads to pins 1 and 17 of J9001
4

Figure 5-9. Type 7062 CRT Termination Installation Instructions

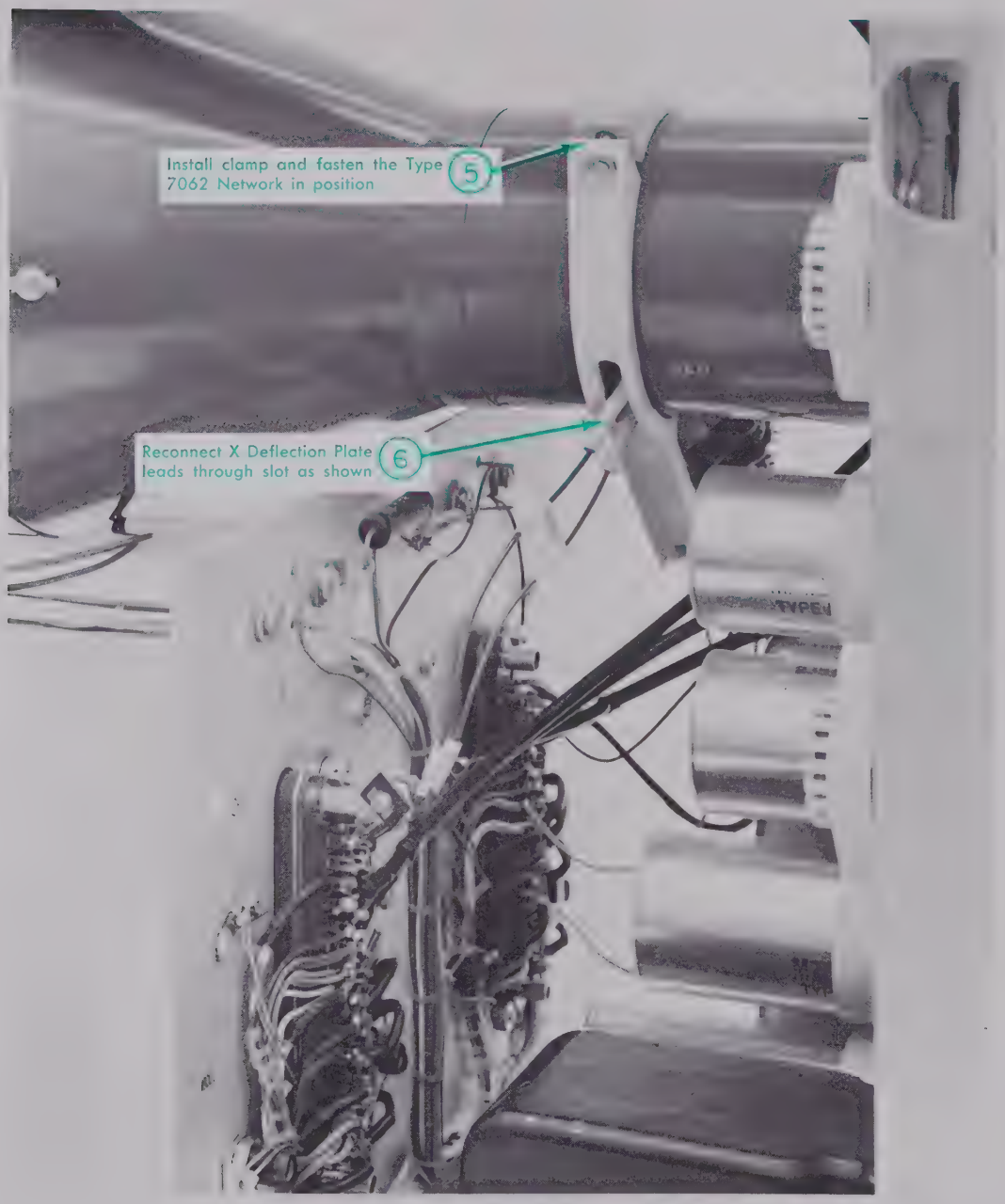


Figure 5-10. Type 7062 Installation Instructions

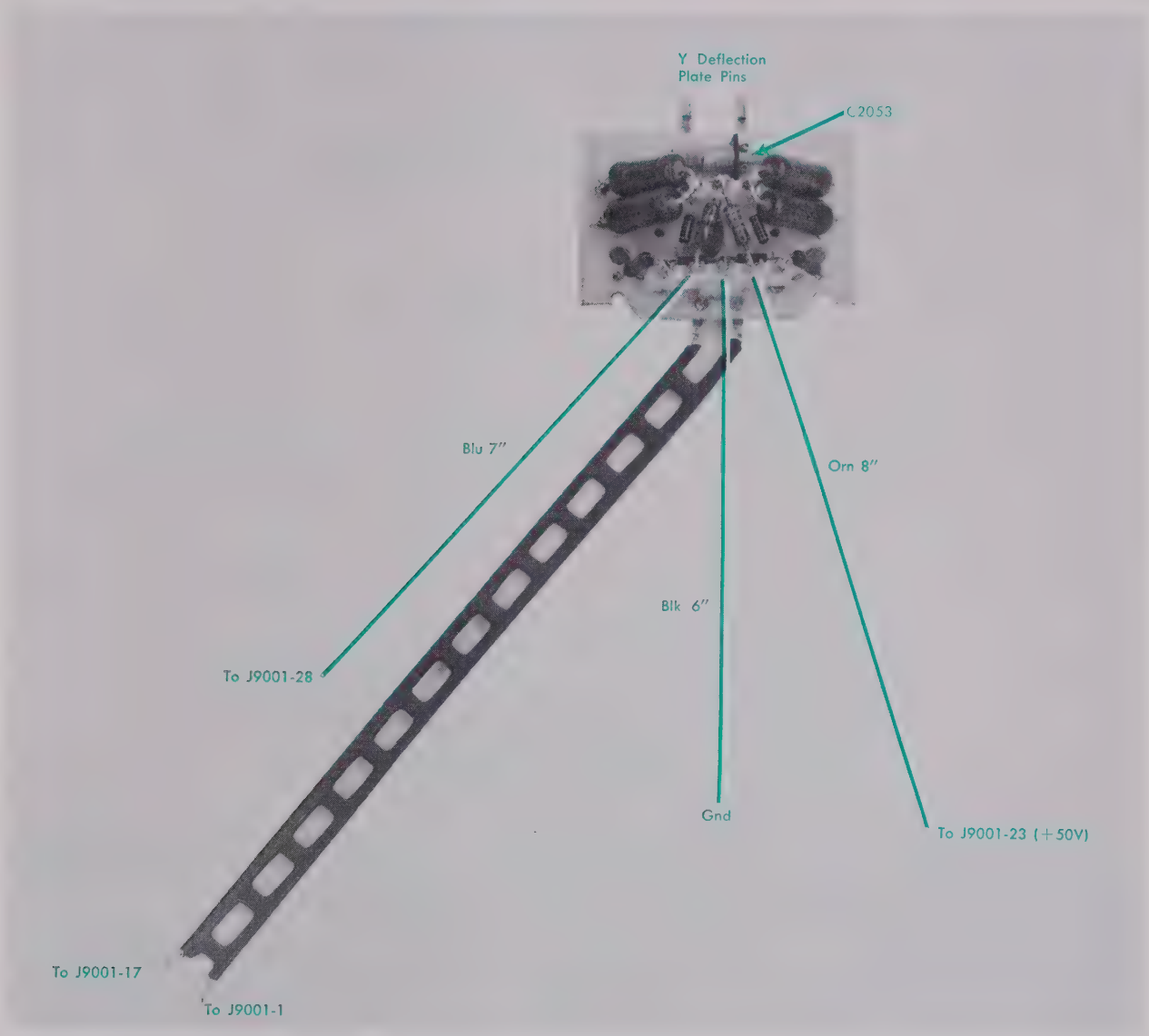


Figure 5-11. Type 7062 Interconnecting Diagram

5-13. SUPPLEMENT FOR TYPE 766H MOD 102 OSCILLOSCOPE

a. Introduction

The Type 766H Mod 102 Main Frame is identical to the regular Type 766H except for the addition of the A ± B DC OFFSET potentiometer R1071 and minor Parts List and Schematic revisions as indicated elsewhere in this paragraph.

b. Adjustment of A ± B DC Offset POT R1071

When the A ± B DC OFFSET potentiometer is properly adjusted, there will be no depositioning of the trace when the MODE switch is set to the ADDED position. To properly adjust, proceed as follows:

1. Set up Time Base Plug-in for automatic triggering to obtain a reference trace on the screen.
2. Set MODE switch to CH 1 and position trace to screen center with CH 1 POSITION control.
3. Set MODE switch to CH 2 and position trace to screen center with CH 2 POSITION control.

4. Set MODE switch to ADDED. Measure the number of graticule divisions the trace has shifted or is offset from screen center.

5. Set MODE switch to ALT. Using Channels 1 and 2 POSITION controls, position the trace to the opposite side of screen center by the exact displacement that was noted in step 4. For example, if the trace was offset from screen center by 1½ divisions, then position the trace 1½ divisions below screen center.

6. Set the A ± B DC OFFSET potentiometer R1071 to bring the trace to screen center.

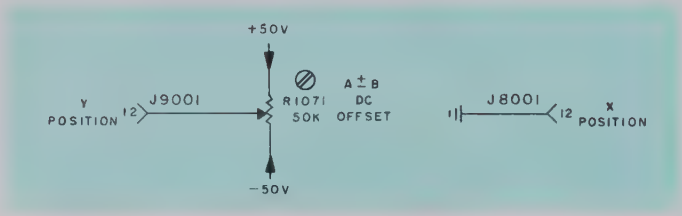
7. Rotate the MODE switch throughout its range. There should be no depositioning of the trace. Repeat preceding steps if necessary to achieve this condition.

c. Electrical Parts List Revision for MOD 102

	Symbol		Part Number	Description
Change	J1005	from	0904 4381	Jack tip, black
		to	0905 7610	BNC connector
Change	W1001	from	5030 1390	Cable Assembly
		to	5030 1890	Cable Assembly
Add	R1071		0109 1410	Resistor, variable, composition, 50K ohms, ±20%
Delete	R1055 & R1056		0107 2631	Resistor, variable, composition, 30K ohms, ±20%, ½W

d. Schematic Changes for MOD 102

Revise schematic as indicated in sketch below.



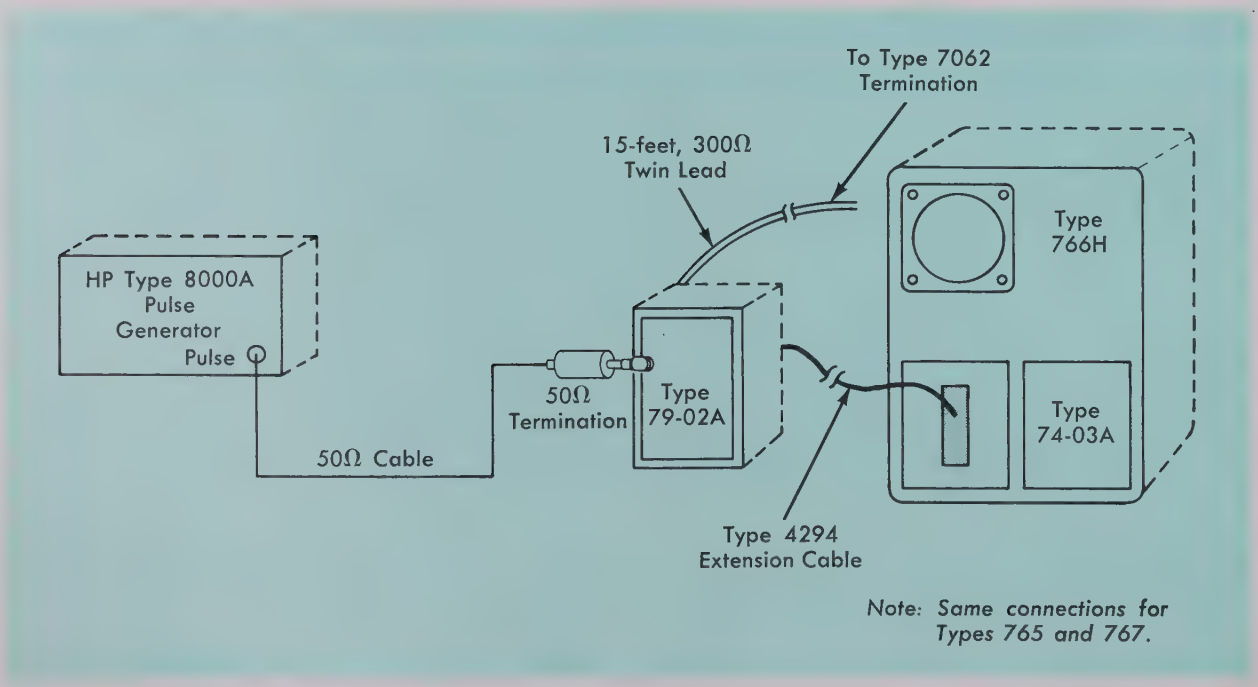


Figure 5-12. Peaking Adjustment Hook-up Diagram

SECTION 6A
ELECTRICAL PARTS LIST AND SCHEMATIC

INTRODUCTION

The Fairchild Types 765, 766, and 767 Family of Oscilloscopes are available in three basic form factors: bench, rack, and portable models. The Portable models are identified by the Type 765 numerical Series; the Bench models by the Type 766 numerical Series, and the Rack-mounted models by the Type 767 numerical Series.

In addition, there are alphabetical suffixes appended to the numerical series to identify special electronic circuits. The suffix H denotes the high-voltage oscilloscope with an accelerating potential of 13 Kv. The low voltage option is 5 Kv and these series oscilloscopes are identified by the absence of the H alphabetical suffix. The suffix F denotes the high-voltage, high-frequency model; the suffix M denotes the militarized model.

The Type 766H Series Oscilloscope may be categorized into three basic Series as indicated in Table given below.

SERIES	TYPES
LOW VOLTAGE	765, 765M, 766, 766M, 767, 767M
HIGH VOLTAGE	765H, 765MH, 766H, 766MH, 767H, 767MH
HIGH FREQUENCY	765H/F, 765MH/F, 766H/F, 766MH/F, 767H/F, 767MH/F

CAPACITORS

Notes: 1. All capacitors are fixed, ceramic, and 500V unless otherwise specified; pf (μμf) denotes picofarads.

2. GMV denotes Guaranteed Minimum Value.

Symbol	Part Number	Description	Recommended Vendor Code	Type
C1001 & C1002	0326 4620	5000 pf, GMV	ERC	801
C1003	0319 3880	electrolytic, 300 μf, +100 −10%, 250V	MAL	FP
C1004	0326 4520	1000 pf, GMV	ERC	831
C1006	0326 7840	plastic, 0.047 μf, ±10%, 200V	AMX	C296AB
C1007	0326 7860	plastic, 0.1 μf, ±10%, 200V	AMX	C296AB
C1008	0319 1050	0.02 μf, +60, −40%, 150V	CRL	DDM
C1009	0327 1890	electrolytic, 25 μf, +100 −10%, 150V	MAL	TCW
C1031 (HV and LV Series only)	0319 1251	variable, 0.4-2.5 pf, 350V	ABD	
C1032	0319 1251	variable, 0.4-2.5 pf, 350V	ABD	
C1101	0319 3890	electrolytic, 400 μf, +150 −10%, 150V	MAL	FP
C1102	0326 7840	plastic, 0.047 μf, ±10%, 200V	AMX	C296AB
C1103	0326 4520	1000 pf, GMV	ERC	831
C1104	0326 7860	plastic, 0.1 μf, ±10%, 200V	AMX	C296AB
C1106	0319 1050	0.02 μf, +60 −40%, 150V	CRL	DDM
C1107	0327 1890	electrolytic, 25 μf, +100 −10%, 150V	MAL	TCW
C1201	0327 6930	electrolytic, 800 μf, +100 −10%, 150V	MAL	FP
C1203	0326 4520	1000 pf, GMV	ERC	831
C1204	0326 7840	plastic, 0.047 μf, ±10%, 200V	AMX	C296AB
C1206	0326 7860	plastic, 0.1 μf, ±10%, 200V	AMX	C296AB
C1207	0319 1050	0.02 μf, +60 −40%, 150V	CRL	DDM
C1208	0327 1890	electrolytic, 25 μf, +100 −10%, 150V	MAL	TCW
C1301	0319 3890	electrolytic, 400 μf, +150 −10%, 150V	MAL	FP
C1302	0326 9550	electrolytic, 10 μf, +100 −10%, 100V	SPG	30D208A1
C1303	0319 1060	0.01 μf, +60 −40%, 150V	CRL	DDM
C1304	0326 7840	plastic, 0.047 μf, ±10%, 200V	AMX	C296AB
C1306	0319 1050	0.02 μf, +60 −40%, 150V	CRL	DDM
C1307	0326 4520	1000 pf, GMV	ERC	831
C1308	0327 1890	electrolytic, 25 μf, +100 −10%, 150V	MAL	TCW
C2003	0326 4660	0.02 μf, GMV	ERC	841
C2004	0327 6940	electrolytic, 25 μf, +100 −10%, 100V	MAL	FP
C2005	0326 7880	plastic, 0.22 μf, ±10%, 200V	AMX	C296AB
C2007 (HV and HF Series only)	0327 6890	electrolytic, 500 pf, +50 −20%, 12KV	CDE	
C2008 & C2009	0316 4930	0.01 μf, +100 −0%, 2000V	RMC	2KV
C2010	0327 6890	500 pf, +50 −20%, 12KV	CDE	
C2011	0316 4930	0.01 μf, +100 −0%, 2000V	RMC	2KV
C2012	0326 7840	plastic, 0.047 μf, ±10%, 200V	AMX	C296AB
C2013	0316 9190	1000 pf, ±20%, 3000V	RMC	3KV
C2014	0316 4930	0.01 μf, +100 −0%, 2000V	RMC	2KV
C2015	0327 7500	plastic, 0.15 μf, ±10%, 400V	AMX	C296AC
C2016	0316 4930	0.01 μf, +100 −0%, 2000V	RMC	2KV
C2017 (HV and HF Series only)	0326 4620	5000 pf, GMV	ERC	801

Symbol	Part Number	Description	Recommended Vendor Code	Type
C2018 & C2019	0326 4620	5000 pf, GMV	ERC	801
C2020	0327 6910	0.0033 μf, ±20%, 5000V	CPC	DA045CB
C2021	0326 7820	plastic, 0.022 μf, ±10%, 200V	AMX	C296AB
C2022	0326 4640	0.01 μf, GMV	ERC	811
C2023	0313 4580	0.02 μf, +100 −0%	RMC	Plug-in B
C2024	0316 9190	0.001 μf, 3KV	RMC	3KV

SEMICONDUCTORS

CR1001 to CR1003	2600 9220	diode, silicon, 1N4384	GEN	
CR1004	2600 6910	diode, FD841	FCI	
CR1006	2600 9240	diode, 1N980A	EIA	
CR1101 & CR1102	2600 9220	diode, silicon, 1N4384	GEN	
CR1104	2600 6910	diode, FD841	FCI	
CR1201 & CR1202	2600 9220	diode, silicon, 1N4384	GEN	
CR1204	2600 6910	diode, FD841	FCI	
CR1301 & CR1302	2600 9220	diode, silicon, 1N4384	GEN	
CR1304	2600 9230	diode, 1N823	EIA	
CR2000	2600 9220	doide, silicon, 1N4384	GEN	
CR2001	2600 2711	rectifier, metallic	ABD	
CR2002	2600 9220	diode, silicon, 1N4384	GEN	
C2003	2600 8020	diode, FDG 3091	FCI	
CR2050 & CR2051 (HV and HF Series only)	2600 3031	rectifier, metallic	ABD	
CR2052	2600 3031	rectifier, metallic	ABD	

LAMPS

DS1401	1201 1280	incandescent, 6.3V	GE	
E1401 & E1402	1200 1310	incandescent, bayonet, #47	GE	
E2001	1200 3960	glow, NEV	GE	

FUSES

F101	1100 5210	3 amperes, slo-blo	LFI	313003
F102	1100 0740	0.5 ampere	LFI	312.500
F110	1100 0760	1 ampere	LFI	312001
F120	1100 0770	1.5 amperes	LFI	31201.5
F130	1100 0760	1 ampere	LFI	312001
F150 ("M" Models only)	1100 5280	2 amperes, slo-blo	LFI	313002

HEATER ELEMENTS

HR1501 to HR1506 ("M" Models only)	6900 2511	heater strip	ABD	

HYBRID COILS

HY1003 to HY1008 (Types 765 & 767 Series only)	2110 1590	bead, ferroxcube	FER	
HY1301 (Types 765 & 767 Series only)	2110 1560	bead, ferroxcube	FER	

Symbol	Part Number	Description	Recommended Vendor Code	Type

ELECTRICAL CONNECTORS

J1001 (Portable Models only)	0905 9320	receptacle, round, 3 contacts	GE	BRI-4
J1001 (Bench and Rack Models only)	0905 8440	receptacle, round, 3 contacts	GE	BRI-4
J1005	0904 4381	jack, tip, black (1V P-P)	ABD	
J2001 (Bench and Rack Models only)	0905 7610	receptacle, BNC, rf, female, 1 contact		UG 625-A/U
J8001 & J9001	0905 7360	receptacle, general purpose, female, 32 contacts	APH	26 190 32
P2001 (Bench and Rack Models only)	0905 9150	cover, electrical, BNC	DAG	

LV SERIES

P2002 (Bench Model only)	0904 4211	HV connector assembly	ABD	
P2002 Portable and Rack Models only)	0904 4212	HV connector assembly	ABD	

HV AND LV SERIES

P2002 (Bench Model only)	0904 4311	HV connector assembly	ABD	
P2002 (Portable and Rack Models only)	0904 4312	HV connector assembly	ABD	

COIL

L2001	2101 8441	Beam Rotate	ABD	

TRANSISTORS

Q1001 & Q1002	2600 7280	DU #6B	FCI	
	2600 7250	alternate, 2N1893		
Q1003	2600 9170	DU #51A	SIL	
	2600 9150	alternate, 2N3442		
Q1051	2600 7210	DU #5	FCI	
	2600 7200	alternate, 2N697		
Q1101 & Q1102	2600 7280	DU #6B	FCI	
	2600 7250	alternate, 2N1893		
Q1103	2600 9170	DU #51A	SIL	
	2600 9150	alternate, 2N3442		
Q1201 & Q1202	2600 7280	DU #6B	FCI	
	2600 7250	alternate, 2N1893		
Q1203	2600 9170	DU #51A	SIL	
	2600 9150	alternate, 2N3442		
Q1301 to Q1303	2600 7280	DU #6B	FCI	
	2600 7250	alternate, 2N1893		
Q1304	2600 9170	DU #51A	SIL	
	2600 9150	alternate, 2N3442		
Q2000 & Q2001	2600 9200	2N3390	GE	
Q2002	2600 7280	DU #6B	FCI	
	2600 7250	alternate, 2N1893		
Q2003	2600 9170	DU #51A	FCI	
	2600 9150	alternate, 2N3442		

RESISTORS

Note: All resistors are fixed, film, ±5%, and ½W unless otherwise specified, K = thousand, M = million.

Symbol	Part Number	Description	Recommended Vendor Code	Type
R1001	0234 9420	36K, 1W	CGW	C32
R1002	0234 8490	15K	CGW	C20
R1003	0234 8040	200	CGW	C20
R1004	0234 8110	390	CGW	C20
R1005	0237 9630	17.8K, ±1%, 1W	CGW	C6
R1006	0234 8040	200	CGW	C20
R1007	0234 8690	100K	CGW	C20
R1008	0234 8040	200	CGW	C20
R1009	0237 0460	30, 2W	CGW	C42S
R1011	0237 9470	12.1K, ±1%, 1W	CGW	C6
R1012	0109 1760	variable, wire wound, 1K, ±10% (+200V ADJ)	CTS	AW
R1013	0237 9470	12.1K, ±1%, 1W	CGW	C6
R1014	0203 1180	composition, 820K	ALB	EB
R1051	0234 8490	15K	CGW	C20
R1052	0236 7380	59K, ±1%	CGW	NS20
R1053	0236 6810	15K, ±1%	CGW	NS20
R1054	0236 5560	750, ±1%	CGW	NS20
R1055 & R1056 (Types 766H and 766MH Series only)	0107 2631	variable, composition, 30K, ±20% (Position)	ABD	
R1101	0234 8530	22K	CGW	C20
R1102	0234 8590	39K	CGW	C20
R1103	0234 8040	200	CGW	C20
R1104	0234 8110	390	CGW	C20
R1105	0237 9470	12.1K, ±1%, 1W	CGW	C6
R1106	0234 8040	200	CGW	C20
R1107	0234 8690	100K	CGW	C20
R1108	0234 8040	200	CGW	C20
R1109	0234 1340	5, 3W	WDL	3X
R1111	0237 9110	5.11K, ±1%, 1W	CGW	C6
R1112	0109 1760	variable, wire wound, 1K, ±10% (+100V ADJ)	CTS	AW
R1113	0237 9110	5.11K, ±1%, 1W	CGW	C6
R1201	0234 8490	15K	CGW	C20
R1202	0234 9290	10K, 1W	CGW	C32
R1203	0234 8510	18K	CGW	C20
R1204	0234 8040	200	CGW	C20
R1205	0237 9470	12.1K, ±1%, 1W	CGW	C6
R1206	0234 8110	390	CGW	C20
R1207	0234 7990	120	CGW	C20
R1208	0234 8690	100K	CGW	C20
R1209	0234 8040	200	CGW	C20
R1211	0233 5400	wire wound, 5, 7W	DAL	RS7
R1212	0237 9110	5.11K, ±1%, 1W	CGW	C6
R1213	0109 1760	variable, wire wound, 1K, ±10% (+50V ADJ)	CTS	AW
R1214	0237 9110	5.11K, ±1%, 1W	CGW	C6
R1301	0234 8530	22K	CGW	C20
R1302	0237 8190	562, ±1%, 1W	CGW	C6
R1303	0109 1760	variable, wire wound, 1K, ±10% (−50V ADJ)	CTS	AW
R1304	0237 9110	5.11K, ±1%, 1W	CGW	C6
R1305	0234 8210	1K	CGW	C20
R1306 & R1307	0234 8040	200	CGW	C20
R1308	0237 9110	5.11K, ±1%, 1W	CGW	C6
R1309	0234 8040	200	CGW	C20
R1311	0237 9110	5.11K, ±1%, 1W	CGW	C6
R1312	0237 9630	17.8K, ±1%, 1K	CGW	C6
R1313	0234 8110	390	CGW	C20
R1314	0234 8040	200	CGW	C20
R1316	0234 7990	120	CGW	C20
R1317	0234 8690	100K	CGW	C20
R1318	0222 4550	wire wound, 5, 5W	WDL	5X
R1401 & R1402	0234 8010	150	CGW	C20
R1403	0107 2343	variable, wire wound, 50, ±10% (SCALE ILLUM)	ABD	
R2000	0203 2070	composition, 330K, ±10%	ALB	EB
R2001	0234 8530	22K	CGW	C20
R2002	0234 8610	47K	CGW	C20
R2003	0234 8540	24K	CGW	C20
R2004	0234 8580	36K	CGW	C20
R2005	0203 1860	composition, 5.6K, ±10%	ALB	EB
R2006	0234 8310	2.7K	CGW	C20
R2007	0203 2700	composition, 3M, ±10%	ALB	EB
R2008	0234 8520	20K	CGW	C20
R2009 F/R	0109 1910	variable, composition, 500K/100K, ±20% (PATTERN CORR/HV ADJ)	CTS	2-45
R2010	0234 8620	51K	CGW	C20
R2011	0203 1160	composition, 680K	ALB	EB
R2012 & R2013	0203 7240	composition, 1.5M, 2W		
R2014	0108 0750	variable, composition, 2.5M, ±20% (FOCUS)	CLS	37
R2015	0203 1040	composition, 220K	ALB	EB
R2016	0109 2300	variable, composition, 500K, ±20%, 1W (INTENSITY)	CLS	53C
R2017	0203 0850	composition, 36K	ALB	EB
R2018	0235 5400	2M, ¼W	ALB	CB
R2019	0203 2150	composition, 1.5M, ±10%	ALB	EB
R2020	0203 1380	composition, 5.6M	ALB	EB
R2021	0203 2170	composition, 2.2M, ±10%	ALB	EB
R2022	0107 2731	variable, 20K/20K/500K (BEAM ROTATE)	ABD	
R2023 (Bench and Rack Models only)	0203 2130	composition, 1M, ±10%	ALB	EB
R2024	0235 5400	2M, ¼W	ALB	CB
R2025	0237 5970	composition, 5.1	ALB	EB
R2026	0203 6120	composition, 33, 2W	ALB	HB
R2027 & R2028	0234 8690	100K	CGW	C20
R2029	0234 8490	15K	CGW	C20
R2031	0234 8580	36K	CGW	C20
R2032	0234 8520	20K	CGW	C20
R2034 (HV and HF Series only)	0236 3170	composition, 430K	CGW	C20
R2035 (HV and HF Series only)	0203 2130	composition, 1M, ±10%	ALB	EB
R2036	0203 3610	composition, 3.6K, 1W	ALB	

SWITCHES

Symbol	Part Number	Description	Recommended Vendor Code	Type
S101	0503 2480	slide, DPDT (115V/230V)	MUT	4633
S102 (part of R1403)	0107 2343	(POWER)		
S103	2800 3050	thermostatic (THERMAL CUTOUT)	KXM	MC10-5
S150 ("M" Models only)	0503 2400	thermostatic	ELM	2200-1
S210	0503 2460	slide, 3PDT (NORMAL/SINGLE)	COW	

TRANSFORMERS

Symbol	Part Number	Description	Recommended Vendor Code	Type
T1001	2001 4851	power	ABD	
T2001	2001 4821	high-voltage	ABD	

TEST POINTS

Symbol	Part Number	Description	Recommended Vendor Code	Type
TP1001	0905 8450	jack, tip, red (+200V)	EFJ	Series 105
TP1101	0905 8450	jack, tip, red (+100V)	EFJ	Series 105
TP1201	0905 8450	jack, tip, red (+50V)	EFJ	Series 105
TP1301	0905 8450	jack, tip, red (−50V)	EFJ	Series 105

Symbol	Part Number	Description	Recommended Vendor Code	Type
		CATHODE-RAY TUBES		
		Low-Voltage Series		
V204	2501 0551*	F7650-O-P1 (MET)	ABD	
	2501 0552*	F7650-O-P2/G (MET)	ABD	
	2501 0553*	F7650-O-P2/B (MET)	ABD	
	2501 0554*	F7650-O-P7 (MET)	ABD	
	2501 0555*	F7650-O-P11 (MET)	ABD	
	2501 0556*	F7650-O-P31 (MET)	ABD	
		High-Voltage Series		
	2501 0561*	F7660-O-P1 (MET)	ABD	
	2501 0562*	F7660-O-P2/G (MET)	ABD	
	2501 0563*	F7660-O-P2/B (MET)	ABD	
	2501 0564*	F7660-O-P7 (MET)	ABD	
	2501 0565*	F7660-O-P11 (MET)	ABD	
	2501 0566*	F7660-O-P31 (MET)	ABD	
		High-Frequency Series		
	2501 0681*	F7670-O-P1 (MET)	ABD	
	2501 0682*	F7670-O-P2/G (MET)	ABD	
	2501 0683*	F7670-O-P2/B (MET)	ABD	
	2501 0684*	F7670-O-P7 (MET)	ABD	
	2501 0685*	F7670-O-P11 (MET)	ABD	
	2501 0686*	F7670-O-P31 (MET)	ABD	

* Depending on sales order

Symbol	Part Number	Description
		CABLE & WIRES
W2051	5028 9061	300-ohm cable termination
—	5028 6900	6″ #24 stranded wire (black)
—	5028 6930	7″ #24 stranded wire (orange)
—	5028 6960	8″ #24 stranded wire (blue)
		CLAMP ASSEMBLY
—	3701 3241	clamp
—	6009 6180	screw, MSBH, 6-32 x 1/2
—	6200 3670	washer, flat, #6
—	6210 0030	washer, lock, #6

Symbol	Part Number	Description	Recommended Vendor Code	Type
		CABLE		
W1001	5030 2640	assembly	MIL	

TYPE 7062 CRT TERMINATION NETWORK (High-Frequency Series Only)

Symbol	Part Number	Description
C2051 & C2052	0319 7450	Capacitor, fixed, ceramic, 15 pf, ±1%, 500V
C2053	0319 1253	Capacitor, variable, 0.65-3.2 pf, 350V
C2054 & C2056	0319 2420	Capacitor, fixed, composition, 1.5 pf, ±5%, 500V
C2057	0319 1050	Capacitor, fixed, ceramic, 0.02 μf, +60 −40%, 150V
CR2051 to CR2056	2600 8670	Diode, 1N3062
L2051 & L2052	2101 9441	Coil, termination, 9 turns, #27 wire
L2053 & L2054	2101 9451	Coil, inductance, 4 turns, #27 wire
Q2050 & Q2051	2600 8410	Transistor, DU #28A
	2600 8390	alternate transistor, 2N3013

RESISTORS

Note: All resistors are fixed, film, ±5%, and ½W unless otherwise specified, K = thousand, M = million.

R2051	0237 5680	20.5K, ±1%, 1/8W
R2052 & R2053	0234 8340	3.6K
R2054	0237 5680	20.5K, ±1%, 1/8W
R2055	0235 6210	composition, 1M, ±10%, 1/4W
R2056	0237 5700	38.3K, ±1%, 1/8W
R2057 to R2059	0237 6420	300, 2W
R2061	0237 6420	300, 2W
R2062 & R2063	0234 7900	51
R2064	0234 8610	47K
R2065	0109 3580	variable, composition, 10K, 0.1W (PEAK ADJ)
R2066	0235 6210	composition, 1M, ±10%, 1/4W

SECTION 6B
SPARE PARTS LIST

SPARE PARTS REQUIREMENTS

a. General

The Types 765, 766 & 767 Transistorized Oscilloscopes are extremely reliable and dependable instruments. Only components thoroughly tested and approved by the engineers of the Quality Assurance Department are used in this instrument. Continued performance tests, environmental and life testing of production units make certain your instrument will give many years of satisfactory service. These new Fairchild instruments are precision-engineered and require no selected parts.

Two lists of "running spares" are included to aid you in periodic maintenance. The running-spare parts lists include recommended quantities and reference symbol numbers. Section 6A of this Instruction Manual gives a complete listing of all components and their recommended vendors so that you may readily procure them from a local supply house or your own stores.

Note: The local Fairchild Field Engineering representative and his service organization can assist you in obtaining any additional components in the shortest possible time. To help expedite service, always give the Type Number and Serial Number of the instrument; always specify the part number and give a description of the component (see Section 6A of this manual).

b. 500-Hour Spares (6 months)

The recommended list for one through three units is given below.

FUSES

Symbol	Quantity
F101	1
F102	1
F110	1
F120	1
F150 ("M" Models only)	1

CATHODE-RAY TUBES

For Type 766 LV Series	F7650-O-P2/B
For Type 766 HV Series	F7660-O-P2/G
For Type 766 HF Series	F7670-O-P2/G

TRANSISTORS

Symbol		Quantity
Q1001	(DU #6B)	3
Q1003	(DU #51A)	2
Q1051	(DU #5)	1
Q2000	(2N3390)	1
Q2002	(DU #10)	1

DIODES

CR1001	(1N4384)	4
CR1004	(FD841)	1
CR1006	(1N980A)	1
CR1304	(1N823)	1
CR2001	(MET)	1
C2003	(FD63091)	1
CR2052	(MET)	1

LAMPS

DS1401	1
E1401	1
E2001	1

c. 2000-Hour Spares (2 years)

The recommended list for one through ten units is given below. Maintain spares indicated plus one for each oscilloscope in use; 2 of each set of the 500-hour spare list given in paragraph (b) plus the quantities listed as follows:

CAPACITORS

Symbol	Quantity	Symbol	Quantity
C1001	1	C1303	1
C1003	1	C2003	1
C1004	1	C2004	1
C1006	2	C2005	1
C1007	1	C2008	2
C1008	1	C2010	1
C1009	1	C2013	1
C1031	1	C2015	1
C1101	1	C2020	1
S1201	1	C2022	1
C1302	1	C2024	1

ELECTRICAL CONNECTORS

Symbol		Quantity
J1001	(Portable Models only)	1
J1001	(Bench and Rack Models only)	1
J1005		1
J2001	(Bench and Rack Models only)	1
J8001		1
P2001	(Bench and Rack Models only)	1
P2002	(Bench Model only)	1
P2002	(Portable and Rack Models only)	1

HEATER ELEMENTS

("M" Series Only)

Symbol	Quantity
HR1501	2

HYBRID COILS

(Types 765 & 767 Series Only)

HY1003	2
HY1301	2

RESISTORS

Symbol	Quantity	Symbol	Quantity
R1001	1	R2002	1
R1002	1	R2004	1
R1003	4	R2005	1
R1004	1	R2006	1
R1005	1	R2007	1
R1007	2	R2008	1
R1009	1	R2009 F/R	1
R1011	1	R2011	1
R1012	1	R2012	1
R1014	1	R2014	1
R1052	1	R2015	1
R1053	1	R2016	1
R1054	1	R2017	1
R1055 (766H & 766MH Series only)	1	R2018	1
		R2019	1
R1101	1	R2020	1
R1102	1	R2021	1
R1109	1	R2022	1
R1111	2	R2023 (Bench & Rack Models only)	1
R1202	1		
R1203	1	R2024	1
R1207	1	R2025	1
R1211	1	R2026	1
R1302	1	R2031	1
R1305	1	R2034 (HV & HF Series only)	1
R1318	1		
R1401	1	R2035 (HV & HF Series only)	1
R1403	1		
R2000	1	R2036	1

SWITCHES

Stock only one each of the following switches for each ten units being maintained:

S101, S102, S103, S150 ("M" Models only), and S210

TRANSFORMERS AND COIL

Symbol	Quantity
L2001	1
T1001	1
T2001	1

TEST POINT JACKS

TP1001	1

d. Miscellaneous

The following items may be stocked in quantities of one for each ten units being maintained:

Name	Part Number
Adapter	0905 9000
Bezel, front	3506 2001
Bushing	4301 2100
Cushion, bezel, front	3801 8442
Fuseholder	1100 1890
Knob, small (Intensity, Focus and Scale Illum Controls)	4501 2022
Knob, small (Astig)	4501 2023
Lampholder	1200 5430
Nut, knurled	6103 4141
Pilot light (red)	1201 2010
Scale, illuminated	4501 0451
Transistor Cover	4202 3001

e. Summary

The quantities of spare parts given in the preceding paragraphs are intended for industrial and military duty under normal environment and heavy-use conditions. It is suggested that the maintenance engineer evaluate:

1. The conditions under which the instruments will be used.
2. The skill of the maintenance technicians.
3. Other similar items on hand.
4. The effect of procurement time of spares and effects of instrument down-time on your organization.

It is recommended that inventories of spare parts outlined above be adjusted accordingly to the requirements of your own laboratory or plant.

In the first analysis, the factory recommends the availability of spares or standby equipments since extensive life testing of your instrument has shown no higher failure rate for any specific component.

LIST OF RECOMMENDED VENDORS

CODE	NAME
ABD	Du Mont Laboratories
AER	Aerovox Corporation
AHH	Arrow-Hart & Hegeman Electric Company
ALB	Allen-Bradley Company
ALC	Allied Control
ALCO	Alco Electronic Products
ALD	Alden Products Company
AMA	Amaton Electronic Hardware
AMP	Amp Inc.
AMR	Amperite Company, Inc.
AMX	Amperex Electronics Products, Inc.
APC	American Phenolic Corporation
APH	Amphenol Electronics Corporation
ARC	Arco Electronics Inc. (Elmenco)
AST	Astron Corporation
AUT	Automatic Metal Products Corporation
BEL	Belfuse
BNS	Bourns Inc.
BUR	Burndy Engrg. Company
BUS	Bussmann Mfg. Company
CAN	Cannon Electric Company
CBS	CBS-Hytron Division of CBS
CDE	Cornell-Dubilier Electric Corporation
CGW	Corning Glass Works
CH	Cutler-Hammer, Inc.
CHC	Chester Cable Corporation
CHM	Chatham Electronics
CIN	Cinch Manufacturing Company
CLS	Clarostat Mfg. Co., Inc.
COC	Continental Carbon
COM	Comar Electric
COW	Continental-Wirt Electronics Corporation
CPC	C. P. Clare & Company
CRL	Centralab, Division of Globe-Union, Inc.
CST	Chicago Standard Transformer Corporation
CTC	Cambridge Thermionic Corporation
CTS	Chicago Telephone Supply Corporation
DAG	Dage Electric Company, Inc.
DAL	Dale Products, Inc.
DLC	Dialight Corporation
DRK	Drake Mfg. Company
EBY	Hugh H. Eby, Inc.
EDL	Edal Industries
EIA	Any manufacturer meeting EIA standards
ELC	Electra Manufacturing Company
ELD	Eldema Corporation
EMC	Electro Motive Mfg. Company
EMW	Elmwood Sensors, Inc.
ERC	Erie Resistor Corporation
ESX	Essex Electronics
FAST	John E. Fast Company
FCI	Fairchild Camera and Instrument Corporation
FER	Ferroxcube Corporation of America
GDE	Good-All Electric Mfg. Company
GE	General Electric Company
GEN	General Instrument Corporation
GEP	General Products Corporation
GLB	Globe Industries
GRC	General Radio Company
GRY	Grayhill, Inc.
GUD	The Gudeman Company
HAM	The Hammarlund Manufacturing Co., Inc.

CODE	NAME
HON	Honeywell
HOP	Hopkins Engineering Company
HP	Hewlett-Packard Company
IEC	International Electronics Corporation
IRC	International Resistance Company
IRP	International Rectifier Corporation
ITT	ITT Components Division
JEF	Jeffers Electronics, Inc.
JHN	E. F. Johnson Company
JWM	J. W. Miller Company
KUL	Kulka Electric Mfg. Co. Inc.
KXM	Klixon Metals and Control Corporation
LED	Ledex Inc.
LEE	Leecraft Mfg. Company
LFI	Littlefuse, Inc.
LIN	Line Electric
MAL	P. R. Mallory & Company, Inc.
MCR	Micro Switch (Division of Minneapolis-Honeywell Regulator Co.)
MIC	Micamold Electronics Mfg. Corporation
MIL	Miller Electric Company
MOT	Motorola Semiconductor Products, Inc.
MOV	M-O Valve Company Ltd.
MUC	Mucon Corporation
MUT	The Muter Company
NYT	New York Transformer Company, Inc.
OAK	Oak Mfg. Company
PHC	Philco Corporation
PHI	Philips Electronic Tube Division
PLS	Plastoid Corporation
POT	Potter & Brumfield, Inc.
PRC	Precision Resistor Co., Inc.
PYR	Pyramid Electric Company
RCA	Radio Corporation of America
RMC	Radio Materials Corporation
ROY	Royal Electric Corporation, Inc.
RTN	Rotron Mfg. Company
SIG	Signalite Inc.
SIL	Silicon Transistor Corporation
SLT	Sealectro Corporation
SOL	Solitron Devices, Inc.
SPG	Sprague Electric Company
STC	Stackpole Carbon Company
STW	Standard Winding Company
SUM	Summit Coil Company
SWW	Stanwyck Winding Company
SYL	Sylvania Electric Products, Inc.
SYN	Syntronic Instruments, Inc.
TEC	Transistor Electronics Corporation
TEX	Texas Instruments, Inc.
THC	Thermal Control, Inc.
TOR	Torrington Mfg., Company
TRS	Tresco, Inc.
TRU	Tru-Ohm Products
TUG	Tung-Sol Electric Inc.
UCN	Ucinite Company
UTC	United Transformer Company
VIC	The Victoreen Instrument Company
WDE	Wood Electric Corporation
WDL	Ward Leonard Electric Company
WES	Weston Electrical Instrument Corporation
WYN	Welwyn International Inc.

INSTRUMENT WARRANTY AND SERVICE NOTICE

WARRANTY

The Instrumentation Division warrants that each new Cathode-ray Oscilloscope, Automotive Test Equipment, and other Electronic or Electrical Test or Measuring Equipment (hereinafter referred to as "Instrument") manufactured or sold by it, is free from defects in material or workmanship under normal use and service for a period of one year from the date of its sale to the first purchaser for use. If, upon examination by Fairchild, the Instrument is determined to be defective in workmanship or material, Fairchild will, subject to the conditions set forth below, either repair the defective part or replace it with a new part. Fairchild shall not be liable for any delay or failure to furnish a replacement part resulting directly or indirectly from any governmental restriction, priority or allocation or any other governmental regulatory order or action, nor shall Fairchild be liable for damages by reason of the failure of the Instrument to perform properly or for any consequential damages. This warranty does not apply to any Instrument that has been subject to negligence, accident, misuse or improper installation or operation or that in any way has been tampered with, altered or repaired by any person other than an authorized Fairchild service organization or an employee thereof, or to any Instrument whose serial number has been altered, defaced or removed, or to any Instrument purchased within, and thereafter removed beyond, the continental limits of the United States.

This warranty shall, at Fairchild's option, become void unless registration thereof is promptly effected as provided below. This warranty is in lieu of all other warranties, expressed or implied, and no one is authorized to assume any liability on behalf of Fairchild or impose any obligation upon it in connection with the sale of any Instrument, other than as stated above.

REGISTERING THE WARRANTY

To register this warranty, the enclosed warranty registration card must be properly filled out and mailed to the Instrument Service Department immediately upon receipt of the equipment. Complete information is necessary. BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD. Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

SERVICE

In order to insure service under our warranty, the enclosed warranty service card must be properly filled out and returned to the factory. In all cases where service or adjustment is requested, please first contact the factory or authorized depot, giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. THE TYPE NUMBER AND SERIAL NUMBER of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing to the factory in this respect, address:

Fairchild Camera and Instrument Corp.
Instrumentation Division
50 Somerset Place, Clifton, New Jersey

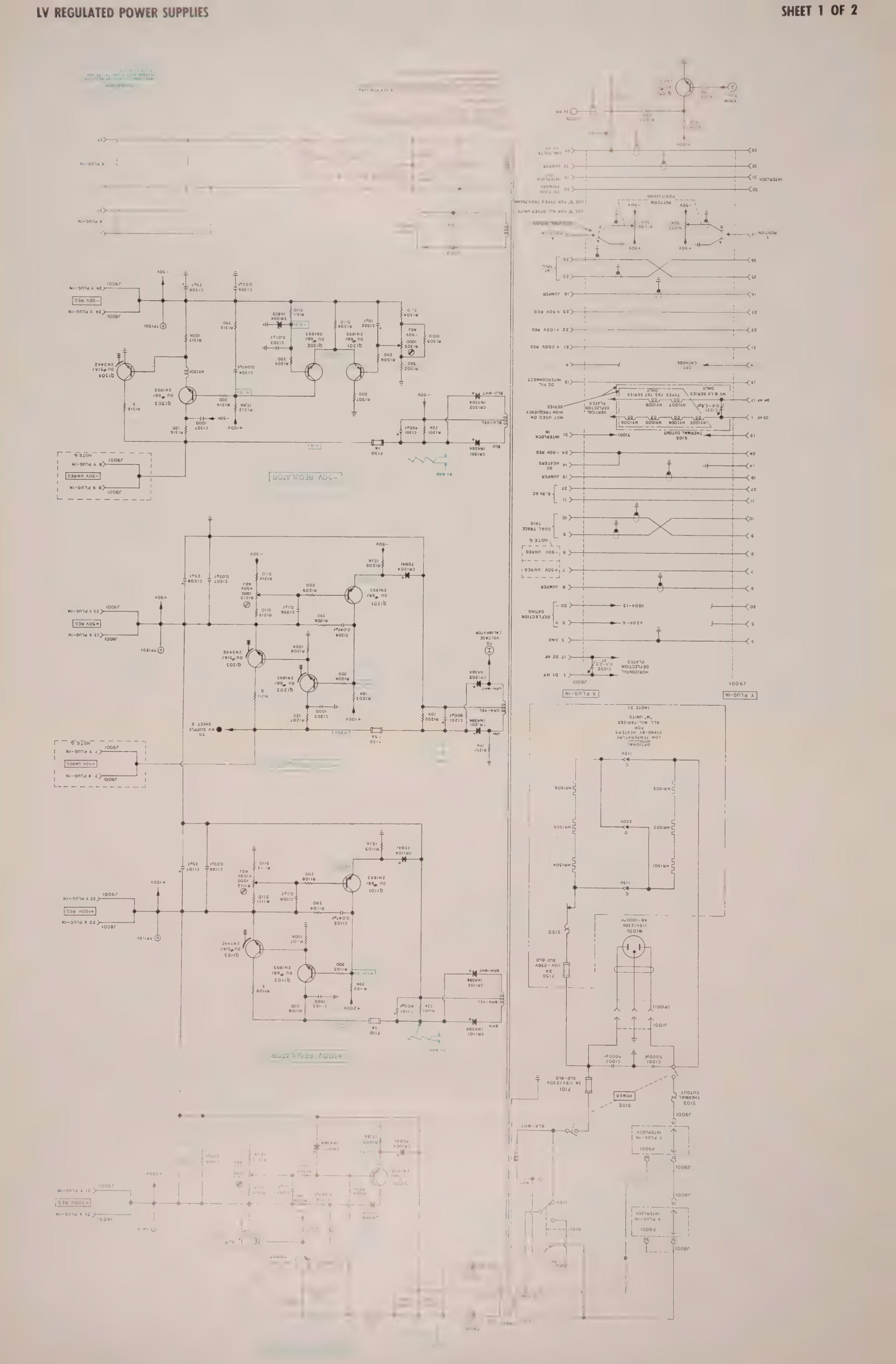
The Instrument Service Department will then send to the customer the written procedure for disposition and shipping instructions. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

REPLACEMENT PARTS

If it is necessary to order a replacement component from the factory, always give the Type number and Serial number of the Instrument. Before ordering parts for in-warranty replacement or purchasing them for out-of-warranty replacement, be sure to consult the Parts List in the Instruction Manual. The Parts List gives the values, tolerances, ratings, and Fairchild part number for all electrical components used in the Instrument. This will help to expedite service.

PATENT NOTICE

Manufactured under one or more U. S. Patents owned or controlled by Fairchild Camera and Instrument Corporation. 50 Somerset Place, Clifton, New Jersey, U.S.A. Patent Numbers supplied upon request.



HV REGULATOR

HV OSCILLATOR

HV RECTIFIER

CRT CIRCUIT

NOTES

1. RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION.
2. CAPACITANCE VALUES ARE IN pf UNLESS OTHERWISE SPECIFIED.
3. ⊘ SERVICE ADJUSTMENT.
4. ⊘ FRONT PANEL SCREWDRIVER ADJUSTMENT.
5. FOR OPTIMUM SINGLE SWEEP OPERATION, INTENSITY CONTROL, R2016 (500K) SHOULD BE CHANGED TO 1MEG.

TYPE 7062 CRT TERMINATION NETWORK (HIGH FREQ SERIES ONLY) SEE TABLE

SERIES	TYPES	CRT
LOW VOLTAGE		
HIGH VOLTAGE		
HIGH FREQ SERIES		

VOLTAGE DATA

Measurements taken as indicated. Voltage with Types 74-81A and

TYPE

74-14 TIME BASE PLUG-IN

Instruction Manual

Serial No. _____

This Plug-in Module is designed for use with the Fairchild Type 766H Series Oscilloscope. Insert this Manual into the binder you received with the Type 766H Series Instruction Manual.

FAIRCHILD
INSTRUMENTATION
A DIVISION OF FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

SCIENTIFIC INSTRUMENT DEPARTMENT
750 Bloomfield Avenue, Clifton, New Jersey, U.S.A.

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Manual No. 6704 2962

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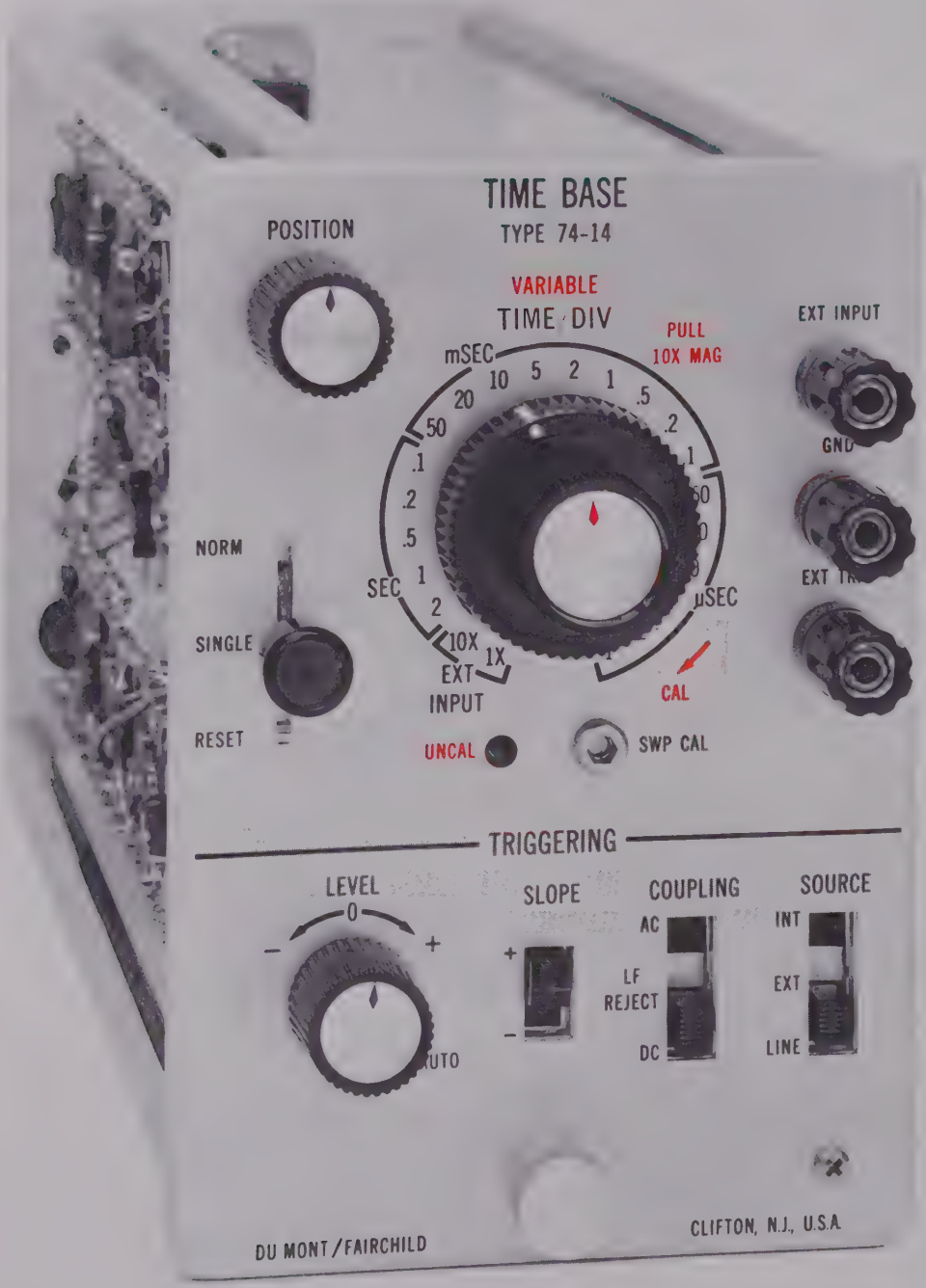


Figure 1-1. Type 74-14 Time Base Plug-In

SECTION 1
OPERATING INSTRUCTIONS

1-1. INTRODUCTION

The Type 74-14 Time Base Plug-In module is designed for use with the Fairchild Type 765 Series Oscilloscopes. Twenty calibrated sweep rates are provided at rates from 1 microsecond/div to 2 seconds/div and with normal automatic, or single sweep operational mode. When the Time Base unit is properly calibrated, the full scale accuracy of the sweep rate is within ±3%.

The VARIABLE control provides a continuous uncalibrated range of sweep rates between the fixed steps of its concentric neighbor. A calibrated 10-times magnification control will expand the sweep about screen center. Use of this feature extends the fastest sweep rate to 100 nanoseconds/division.

1-2. TECHNICAL SUMMARY

The performance specifications for the Type 74-14 Time Base Plug-in are listed on the next page.

1-3. FIRST TIME OPERATION (Figures 1-2 to 1-4)

Unless otherwise designated, it is presumed that a Y Amplifier Plug-in module is inserted in the Y cavity (left-hand side) and the Type 74-14 Time Base Plug-in unit is inserted in the X cavity (right-hand side) of the Main Frame. If the Type 74-14 Plug-in unit is inserted in the Y cavity of the Main Frame, it will provide vertical deflection of the trace and the information must be translated accordingly. In the instructions which follow, capital letters within the text indicate front-panel controls, connectors, or settings.

The following illustrations are designed to aid the operator in becoming familiar with the oscilloscope.

Figure 1-2. Front-Panel Facilities, Time Base System

Figure 1-3. Front-Panel Facilities, Triggering and External Input

Figure 1-4. Initial Setup of Type 74-14 Time Base Plug-In

We know that you are anxious to get acquainted with your new instrument. To aid you in this endeavor, you may set up the instrument using the built-in calibrator signal to demonstrate the effects of the various controls on the display. See Figure 1-4.

1-4. SWEEP TRIGGERING

To obtain a stable display, the sweep must consistently start at the same relative to recurring cycles of the input waveform. If the sweep is allowed to occur at random or at a rate unrelated to the rate of occurrence of the input waveform, the displayed pattern will be traced out at a different point on the screen each time the sweep runs. This will either cause the waveform to drift across the screen or to be unintelligible. The sweep therefore must be triggered by the input signal, or by some signal which bears a fixed time relationship to the input signal. For present purposes, the starting of each horizontal waveform across the screen may be called "triggering the sweep." The following instructions tell you how to select and use the proper triggering signal for various applications.

1-5. TRIGGER SOURCE SELECTION

a. Internal

For most applications, the sweep may be triggered by the Y input signal. The only requirement is that the signal amplitude be sufficient to trigger the sweep. To obtain triggering of the sweep from the input signal, set the SOURCE switch to INT. Internal triggering is convenient since no external triggering connections are required. Satisfactory results are obtained in most applications.

b. External

Sometimes it is advantageous to trigger the sweep with an external signal. External triggering is especially useful where signals are going to be sampled from several different places within an instrument. With external triggering, the triggering signal usually remains constant in amplitude and shape. Thus, it is possible to observe the shaping and amplification of a signal in an external circuit without resetting the oscilloscope triggering controls for each observation. Also, time and phase relationships between the waveforms at different points in the circuit can be seen. For example, if the external triggering signal is derived from the waveform at the input to a circuit, the time relationship and phase of the waveforms at each point in the circuit are compared to the input signal by the displayed waveform.

When a stable, external triggering signal is available, it is possible to observe and accurately measure jitter of the displayed waveform with respect to the trigger input signal. This is not possible when the

SPECIFICATIONS

TIME BASE SYSTEM

Calibrated Sweep Range

Calibrated linear sweep rates from 1 μsec/div to 2 sec/div in 20 steps of 1, 2, and 5 sequence

Uncalibrated Sweep Range

The VARIABLE control provides a continuous uncalibrated range of sweep rates between ranges and extends the 2 sec/div range to 6 sec/div (60 seconds full scale)

The VARIABLE knob is provided with a push-pull switch; the pulled knob indicates 10X MAG of the display or if the UNCAL lamp is lit, uncalibrated Vernier gain setting

Sweep Accuracy

±3% measured over the centered 8-div portion of the CRT screen

Sweep Expansion

A calibrated 10X MAG control will expand the sweep about screen center; extends fastest sweep rate to 100 nanoseconds/div

Expansion Accuracy

±5% for sweep rates up to 1 microsecond/div, ±10% at faster sweep rates to 0.01 μsec/div

Expanded Sweep Positioning

Sufficient to position any full scale portion of the expanded trace on the screen

Sweep Calibration

A front-panel screwdriver SWP CAL control is provided to permit normalization of the plug-in unit to the Main Frame

Single Sweep

An unblanked single-sweep mode is available with manual reset via a front-panel switch

TRIGGERING SYSTEM

Internal

Sweep will trigger from ½ division of Y signal on driven and single sweep positions. Less than 0.4 division is required in the auto triggering position. A choice of trigger polarity (slope) is available

Line Trigger

Line frequency triggering can be selected in either polarity and the triggering point may be shifted with the Trig LEVEL control

External Trigger

0.5 volt peak-to-peak from dc to approximately 300 Kc will trigger the sweep. 0.75 volt peak-to-peak will trigger the sweep from dc to over 500 Kc in Driven and Single sweep positions. Approximately 0.4 volt peak-to-peak is required in Auto triggering operation. Trigger leveling, polarity selection and ac or dc coupling are included

AC Coupling

High-pass filter with low-frequency cutoff of 80 cycles

DC Coupling

Direct coupling is provided to optimize trigger sensitivity when very slow waveforms are applied; to maintain the initial reference position of the trace with respect to the CRT scale at a given trigger level setting; and to avoid trigger point variations due to random repetition rate trigger signals

LF Reject

Differentiated trigger input; high-pass filter is provided to reject hum and low-frequency amplitude modulation; low-frequency cutoff nominally 15 Kc. Signals should rise or fall in less than 100 μsec to pass the LF reject filter

Trigger Slope

Selection of positive or negative slopes on Internal, Line, or External triggering is available

Trigger Level

A range of ±10 volts for External Trigger Input or 1½ times full scale on internal triggering

Automatic Triggering

Auto triggering is available on Internal, External, and Line trigger sources. Auto triggering simplifies synchronization and provides a continuous base line at a frequency of approximately 50 cycles

HORIZONTAL-DEFLECTION SYSTEM

Bandwidth

Direct Coupled: DC to 350 Kc; down 3 db at 350 Kc

Capacitively Coupled: low-frequency cutoff is 2 cycles

Sensitivity

Two fixed ranges of 1X and 10X provide sensitivity of greater than 1.0 volt to greater than 10.0 Volts/Div. 10 to 1 fixed expansions extend the basic range from greater than 0.1 volt to greater than 10.0 Volts/Div

Input Impedance

1 megohm, 37 pf maximum

TIME/DIV

Outer knob (black): selects calibrated sweep rates as indicated on front panel only when the concentric VARIABLE control is set to CAL

PULL 10X MAG

Pull out VARIABLE control for 10X MAGnification of the internal sweep or of the EXT INPUT signal

VARIABLE

Inner knob (red pointer): provides a continuous, uncalibrated range of sweep rates between the fixed steps of its concentric neighbor

NORM/SINGLE

Lever switch: choice of NORMAL or SINGLE sweep operation; spring-loaded RESET position permits rearming of single sweep

SWP CAL

Screwdriver control: permits normalization of the Plug-in unit to the Main Frame

Figure 1-2. Front-Panel Facilities, Time Base System

POSITION

Control: positions the trace horizontally when Time Base Plug-in is normally inserted in its X cavity. If this Plug-in is inserted in the Y cavity, it will position the trace vertically

UNCAL

Lamp: lights and serves as a warning indicator when using uncalibrated sweep or when VARIABLE control is not turned fully clockwise

LEVEL

Control with switch: selects trigger signal voltage at which the sweep is fired; switch actuation permits AUTOmatic triggering

EXT INPUT

Binding posts: for applying external signals to the horizontal deflection amplifier when TIME/DIV switch is set to EXT INPUT

EXT TRIG

Binding posts: for applying external triggering signal through EXT position of TRIGGER SOURCE switch

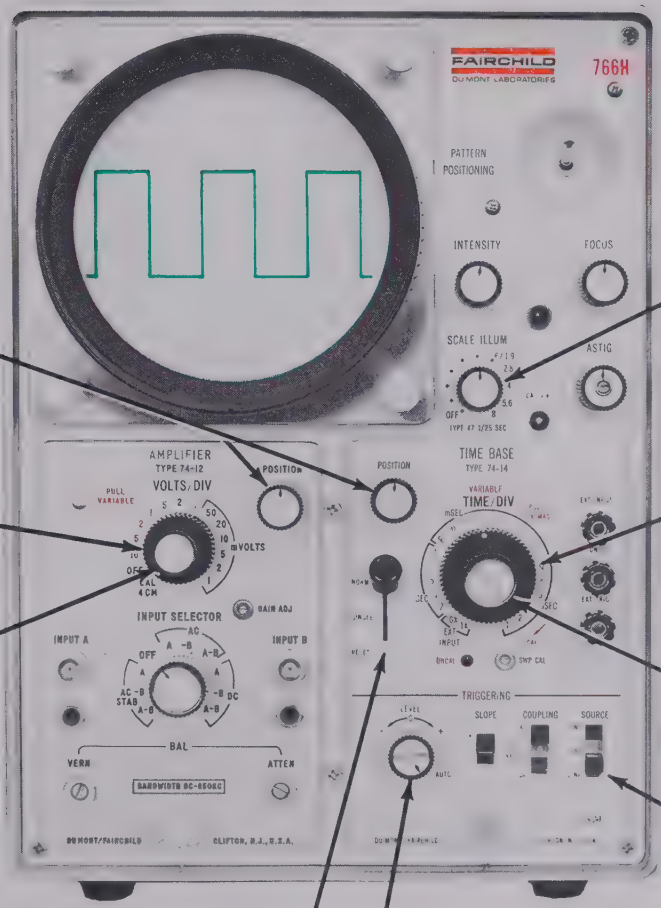
TRIGGERING

Two, 3-position and one, 2-position slide switches: enables trigger selection from internal or external SOURCE, direct or capacitive COUPLING, and choice of SLOPE polarities

Figure 1-3. Front-Panel Facilities, Triggering and External Input

To obtain the calibrator display, set the controls exactly as shown and perform the numbered steps in sequence.

Use the same procedure when difficulty is experienced when obtaining a display. This will eliminate "cockpit" troubles due to misalignment of controls.



Set ASTIG, FOCUS, & INTENSITY controls to center of range

1 Rotate clockwise to turn on the oscilloscope

Set POSITION controls to center of range 6

2 Set outer knob (TIME/DIV) to 5 mSEC

Set outer knob (VOLTS/DIV) to CAL 7

3 Push in inner knob (VARIABLE) and rotate it fully clockwise. Note that UNCAL lamp is off

Push in inner knob (VARIABLE) and rotate it fully clockwise 8

4 Set TRIGGERING switches to +, AC, LINE

Readjust INTENSITY, FOCUS & ASTIG controls for a sharp pattern

Set to NORMAL 9

5 Rotate clockwise to AUTO until switch is actuated (click is heard)

NOTE

The front-panel screwdriver BAL controls on the Y Plug-in must be properly adjusted to obtain an on-screen trace. See the appropriate Y Plug-in Instruction Book

Figure 1-4. Initial Setup of Type 74-14 Time Base Plug-In

sweep is triggered internally. Internal triggering will not permit base line to show on screen prior to the rise of the signal being observed. A trigger preceding the signal may be used to externally trigger the oscilloscope to display the entire signal.

External triggering should also be used with most dual-trace amplifier modules when these are operated in the alternate mode to show the proper time relationship between the two displayed signals. To obtain a stable display, the external triggering signal must have an amplitude of at least 0.5 volt, peak-to-peak, and bear a fixed time relationship to the displayed signal. To use an external signal for triggering the sweep, connect the signal to the EXT TRIG connector and set the Trigger SOURCE switch to EXT.

c. Line

If the pattern on display bears a fixed time relationship to the power-line frequency, the sweep may be triggered by this signal. To accomplish this, set the SOURCE switch to LINE.

1-6. TRIGGER COUPLING SELECTION

a. AC Coupling

Selection of the AC triggering mode is accomplished by setting the Trigger COUPLING switch to AC. This mode is provided with a high-pass filter that has a low-frequency cut-off nominally at 80 cycles. This feature prevents erratic triggering when positioning the pattern vertically while using internal triggering. In the AC mode, triggering is unaffected by the dc components of the triggering signal or by the vertical positioning of the trace. The triggering level can be selected to provide the desired display via use of the Trigger LEVEL control.

When using the AC mode, the Trigger COUPLING switch is set to AC. The trace always starts at the same point on the *Waveform* for a given Trigger LEVEL control setting regardless of the vertical positioning.

b. DC Coupling

The DC mode is especially useful for viewing waveforms which change very slowly and which are therefore discriminated against by the low-frequency cut-off of the AC position (80 cps). Because of the coupling network time constant in the AC mode, signals having random repetition rates are sometimes viewed more stably in the DC mode.

This mode permits excellent triggering on all types of waveforms and is most useful in the following applications:

(1) for preserving very low frequencies;
(2) for maintaining the initial reference position of the trace with respect to the CRT scale at a given Trigger LEVEL control setting; and
(3) for avoiding trigger point variations due to random repetition rate triggering signals.

When using the DC mode, the Trigger COUPLING switch is set to DC. The trace always starts at the same point on the *Scale* for a given setting of the Trigger LEVEL control regardless of the vertical positioning.

c. LF Reject Coupling

The LF REJECT mode is a special high-frequency form of the AC mode and is used to reject low-frequency components in the triggering signal. Use AC triggering unless low-frequency rejection is required. Triggering signals with frequency components below 15 Kc may not initiate the sweep circuits when the LF REJECT mode is used. Also, this 15 Kc cut-off feature will assure stable triggering from the dual-trace plug-in when it is set up for alternate sweep mode, and using internal trigger source. To insure stability, the triggering signal should rise in less than 100 μsec.

Occasionally, it is required to obtain stable triggering from a complex high-frequency waveform that contains undesirable low-frequency noise or line-frequency components. In such cases, the additional noise and line pickup may make it difficult to obtain a stable display. If this occurs, select the LF REJECT triggering mode, thereby eliminating the effects of these undesired components. The low-frequency components are blocked from the triggering circuit while the high-frequency triggering waveform is passed to produce the stable triggering that is required. In all other respects, the LF REJECT triggering mode is identical to the AC mode.

1-7. TRIGGER SLOPE SELECTION

When the Trigger SLOPE switch is set to +, the sweep is triggered on the rising or positive slope of the excitation signal. When the Trigger SLOPE switch is set to −, the sweep is triggered on the falling or negative slope of the excitation signal.

1-8. TRIGGER LEVEL SELECTION

The Trigger LEVEL control permits selection of a specific voltage which the triggering signal must exceed before the sweep fires. When the Trigger SLOPE switch is set to the + position, adjustment of the Trigger LEVEL control makes it possible to trigger the sweep consistently on the positive slope of the excitation signal. Conversely, with the Trigger SLOPE switch set to the − position, adjustment of the Trigger LEVEL control makes it possible to trigger the sweep consistently on the negative slope of the excitation signal. See specifications for trigger level ranges.

1-9. SWEEP OPERATIONAL MODES

a. Introduction

When the Trigger Mode switch is set to NORMAL, the oscilloscope may be set up for triggered or automatic sweep. In the SINGLE mode, the time base moves but one stroke until manually reset.

b. Automatic Sweep

In some applications, it is desirable to have the sweep free-running, whether synchronized or not. When using the AUTO mode, a horizontal reference trace will appear on the screen even in the absence of an input signal. This AUTOmatic mode is very useful while testing equipment since a reference trace will always be visible regardless of whether a signal is applied to the oscilloscope or not.

The AUTO mode simplifies synchronization of signals or periodic waveforms having repetition rates greater than 50 cycles.

To obtain AUTOmatic sweep operation, set the Trigger LEVEL control fully clockwise to AUTO (switch is actuated) and the Trigger Mode switch to NORMAL.

c. Triggered Sweep

A stable pattern for practically all types of signals can be obtained by using triggered sweep. Its use is mandatory for viewing random or non-periodic signals having low repetition rates. Use of the triggered sweep mode of operation in the majority of applications is the preferred condition under which optimum triggering performance can be expected of this instrument.

When the oscilloscope is set for triggered sweep, the spot will be visible only during forward sweep time. The INTENSITY control must be properly adjusted to make the sweep visible. For triggered sweep operation, proceed as follows:

1. Apply the desired signal to the Y Input connector and set front-panel controls as previously indicated in Figure 1-4.
2. Adjust VARIABLE control in conjunction with Y VOLTS/DIV switch to obtain a vertical deflection of approximately 5 divisions.
3. Adjust Trigger LEVEL control to initiate the sweep and the POSITION controls to center the display.
4. Rotate the TIME/DIV and the VARIABLE controls to obtain the desired display. Readjust the Trigger LEVEL control if necessary.
5. Adjust INTENSITY, FOCUS, and ASTIG controls to obtain a sharp trace of suitable brightness.
6. If there is any multiple triggering of the sweep, the Trigger LEVEL control may be adjusted to select the signal levels which will best actuate the trigger circuit. Thus, undesirable signals of lesser amplitude will be rejected by the trigger channel.
7. Set Trigger COUPLING switch to LF REJECT to obtain a more stable display when using high-frequency triggering signals.

d. Single-Sweep Operation

Single-sweep operation infers that the time base moves but one stroke until reset. Using a repetitive sweep to view a varying waveform would result in an overlapped and unintelligible display caused by many displays being superimposed on one another. However, when it is desired to view a single display of an input signal which continually varies in amplitude, shape, or time, the Trigger Mode switch should be set to SINGLE for single-sweep presentation. Thus, by commanding but one stroke of the sweep at a time, the SINGLE position eliminates the overlapping caused by the multiple traces and enables the display to be viewed and/or recorded clearly.

A single trace will sweep across the screen each time the sweep is triggered and at the end of its travel, the beam will rest off screen. To rearm the sweep, push the lever-operated switch to the momentary contact RESET position. The sweep will then retrace to the left side of the screen and is armed to fire upon receipt of the next trigger.

1-10. SWEEP RATE CONTROLS

a. Uncalibrated or Vernier Operation

The VARIABLE control, concentric with the TIME/DIV knob, may be used to slow down the sweep rate. A continuously variable rate of greater than 3 to 1 is available to give overlap between the sweep stops. The slow end of the sweep range may therefore be extended from 2 sec/div to 6 sec/div or 1 minute full scale. The UNCAL lamp will be lit whenever the VARIABLE control is not turned fully clockwise.

b. Calibrated Sweep Magnification

When the VARIABLE control knob is pulled out and turned fully clockwise, any portion of the trace may be expanded horizontally by a factor of 10 about the screen center. This feature extends the fastest sweep rate to 100 nano-seconds/div. Thus, to achieve a 10X expansion of a desired segment of the trace, set that segment to the screen center by the POSITION control, pull out the VARIABLE control and turn it fully clockwise. Any portion of the expanded display may be observed by adjusting the POSITION control.

When the instrument is set up for calibrated sweep expansion, the sweep rate indicated by the setting of the TIME/DIV control must be divided by the expander factor of 10 to obtain the actual time required

for the spot to move one division. The expanded sweep rate may be expressed as follows:

$$\text{Expanded Sweep Time/Div} = \frac{\text{TIME/DIV setting}}{10}$$

For example, if the TIME/DIV control is set to 10 mSEC, and the VARIABLE control is pulled out and rotated fully clockwise, the actual time per division is 10 milliseconds, divided by 10, or 1 millisecond per division.

$$\text{Or using the formula: } \frac{10 \text{ msec/div}}{10} = 1 \text{ msec/div}$$

1-11. SWEEP CALIBRATION ADJUSTMENT

a. Normalizing the Sweep

Whenever the Type 74-14 Time Base is removed from the Main Frame and inserted in another, the front-panel screwdriver SWP CAL control must be reset. This procedure is necessary to compensate for difference in deflection plate sensitivities. In addition, if the Type 74-14 Time Base is switched from the X cavity to the Y cavity of the same Main Frame, readjustment will be necessary since the differences in deflection plate sensitivity between X-Y channels affects the calibration of the Time Base Plug-in. To properly normalize the gain and sweep calibration, proceed as follows:

1. Preset front-panel controls as follows:

Control	Setting
VOLTS/DIV (Y Plug-in)	CAL
Trigger Mode	NORMAL
Trigger LEVEL	AUTO
Trigger SOURCE	LINE
Trigger COUPLING	AC
Trigger SLOPE	+
TIME/DIV	10 mSEC
VARIABLE	CAL (pushed and fully cw)

2. Adjust SWP CAL front-panel screwdriver control for precisely 6 cycles of the calibrator display (60-cycle line) in 10 divisions.

Note: For 50-cycle line, adjust SWP CAL control for 5 cycles of the calibrator display; for 400-cycle line, set TIME/DIV switch to 0.5 mSEC and adjust SWP CAL control for 2 cycles.

b. Calibrating the X Amplifier

The X Amplifier of the Type 74-14 may be calibrated for 1 volt/division by readjusting the SWP CAL control.

1. Set TIME/DIV switch to EXT INPUT 1X and pull out the concentric VARIABLE control for 10X magnification.

2. Set INPUT SELECTOR switch of Y Plug-in to OFF or disconnect the vertical input signal.

3. Interconnect the CAL 1V signal on the Main Frame to the EXT INPUT connector on the Type 74-14.

4. Observe two dots on the screen. The dots should appear quite round and should be connected by a dim line. Adjust the dots for exactly 10 divisions of separation with the SWP CAL control on the Type 74-14. Dim the intensity to avoid screen burns.

Note: It is recommended that the sweep *or* the X Amplifier be calibrated before use (see paragraph a or b above) to assure specified calibration accuracy.

1-12. TIME MEASUREMENTS

a. How to Make Elapsed Time Measurements Using the CRT Scale

Any horizontal distance on the screen of the oscilloscope can be used to represent a precise interval of time when the time-base circuits are set up for calibrated sweep (VARIABLE control set to CAL). Use of this feature permits you to accurately measure the elapsed time between the desired point of interest on the display. To measure the time interval, proceed as follows:

1. Using the calibrated scale, measure the horizontal distance in divisions between that portion of the display whose time interval you wish to find.
2. Multiply the horizontal dimension obtained in Step 1 by the TIME/DIV control setting to obtain the time interval. See Figure 1-5.

b. How to Find Repetition Rate of Frequency Using the CRT Scale

The repetition rate or frequency for periodic signals can be expressed as the number of cycles or pulses per unit of time (VARIABLE control set to CAL).

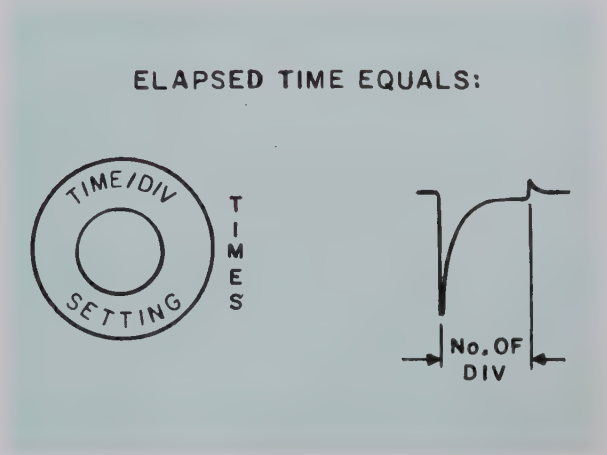


Figure 1-5. Elapsed Time Measurement

To use the oscilloscope for measuring the repetition rate or frequency of periodic signals, proceed as follows:

1. Using the CRT scale, measure the horizontal distance in divisions occupied by one cycle of the display under observation.
2. Multiply the horizontal dimension obtained in Step 1 by the TIME/DIV control setting.
3. Take the reciprocal of the product obtained in Step 2 (that is, divide it into one). The resulting quotient is the desired frequency or repetition rate in cycles per second. See Figure 1-6.

$$\text{Cycles/second} = \frac{1}{\text{Time (seconds)}}$$

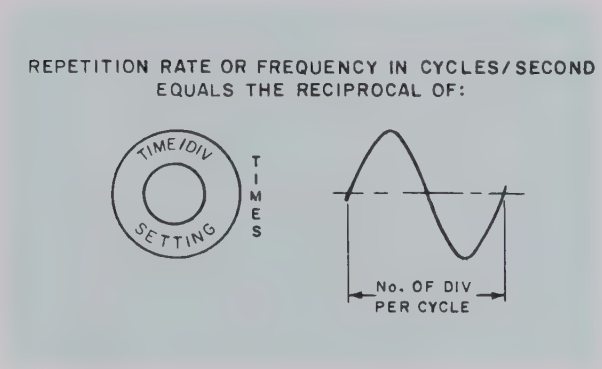


Figure 1-6. Finding the Frequency

1-13. PHASE-SHIFT MEASUREMENTS

To measure the phase difference between two sine waves, proceed as follows:

1. Set up the Type 74-14 Time Base for externally triggered operation.
2. Apply one of the sine waves to INPUT A and the other to INPUT B of the Type 74-12 Amplifier. Set INPUT SELECTOR switch to INPUT A, AC.
3. Adjust the TME/DIV switch until at least one cycle of the display is observed.
4. Position the display so that one of the positive slopes crosses the horizontal center line at the left hand side of the scale.
5. Measure the horizontal distance occupied by one cycle of the waveform. Label this distance A.
6. Set the INPUT SELECTOR switch of the Type 74-12 Amplifier to INPUT B, AC. If a phase difference has occurred between the two input sine waves, the display will shift horizontally.
7. Measure the horizontal shift of the INPUT B display. Label this distance B.
8. Divide the distance measured in step 6 by the distance measured in step 4 and multiply the quotient by 360°. The resulting product is the phase difference between the two sine waves. See Figure 1-7.

$$\text{Phase-shift difference} = \phi = \frac{B}{A}\ 360°$$

Note: Waveforms A and B can be made to appear simultaneously if a Type 76-02A Dual-Trace Amplifier is used.

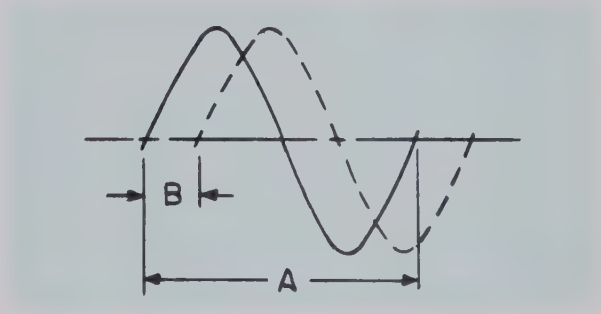


Figure 1-7. Phase-Shift Measurement

1-14. X-Y DISPLAYS

CAUTION

KEEP INTENSITY LOW

Screen damage can result from too intense a beam resting at one point on the screen.

When desiring to view one voltage plotted against another (not the internal time base), simply connect the signals to the EXT INPUT binding post on the X Plug-in and the Y Input terminals on the Amplifier plug-in. Adjust the oscilloscope controls to obtain an appropriate display on the cathode-ray tube screen. The TIME/DIV control must be set to one of the two EXT INPUT settings (1X or 10X) for X-Y display. The X-Y displays may be used to show sweep signal generator plots, Lissajous phase measurements, curve tracer information, and other similar signal relationships.

NOTES

SECTION 2
MAINTENANCE AND RECALIBRATION

2-1. INTRODUCTION

This section of the Instruction Manual contains the circuit description, trouble-shooting instructions, and calibrating procedures for the Type 74-14 Time Base Plug-in Unit.

To simplify circuit description of the Type 74-14 Time Base, functional block diagrams are provided as follows:

Figure 2-1. Trigger Amplifier, Functional Block Diagram
Figure 2-2. Sweep Generator, Simplified Block Diagram
Figure 2-3. X Deflection Amplifier, Functional Block Diagram
Figure 2-4. Timing Diagram, Type 74-14 Time Base

The circuit description will be keyed to the aforementioned illustrations. Emphasis is placed on the interrelation of circuits rather than on detail of operation. It is also recommended that the schematics at the rear of the manual be referred to in following the circuit description.

2-2. TRIGGER CIRCUIT DESCRIPTION (Figure 2-1)

a. Trigger Input

The input to the trigger amplifier V801 may be selected from one of three sources via the Trigger SOURCE switch as follows:

1. In EXT position, the signal is obtained from an external source through the EXT TRIG front-panel connector.
2. In INT position, the signal is derived from the Y Amplifier.
3. In LINE position, the signal is tapped from one side of the 6.3 VAC heater circuit.

A choice of AC, LF REJECT, or DC coupling is provided by the Trigger COUPLING switch. In the AC position, the trigger signal is applied to a high-pass filter consisting of C8002, C8003, and R8003 providing a low-frequency cutoff of 80 cycles. The cutoff frequency is raised to 15 Kc in the LF REJECT position and the high-pass filter now consists of C8003 and R8002. In the DC position, the high-pass filters are disconnected and the triggering signal is applied directly to the trigger amplifier. The RC network, R8004 and C8004, in series with the grid of V801, serves to protect the input circuit from damage to excessive input voltage. Shunt capacitor C8004, preserves the high-frequency signal component.

b. Trigger Amplifier

The trigger amplifier V801 is a cathode-coupled amplifier. Output is always taken from the B-Section plate (pin 6). For positive-going signals, connection is made to the grid of V801B (pin 7), and for negative-going signals, connection is made to the grid of V801A (pin 2). In each case, the opposite grid is connected to a dc bias source, adjustable by means of the Trigger LEVEL control R8013.

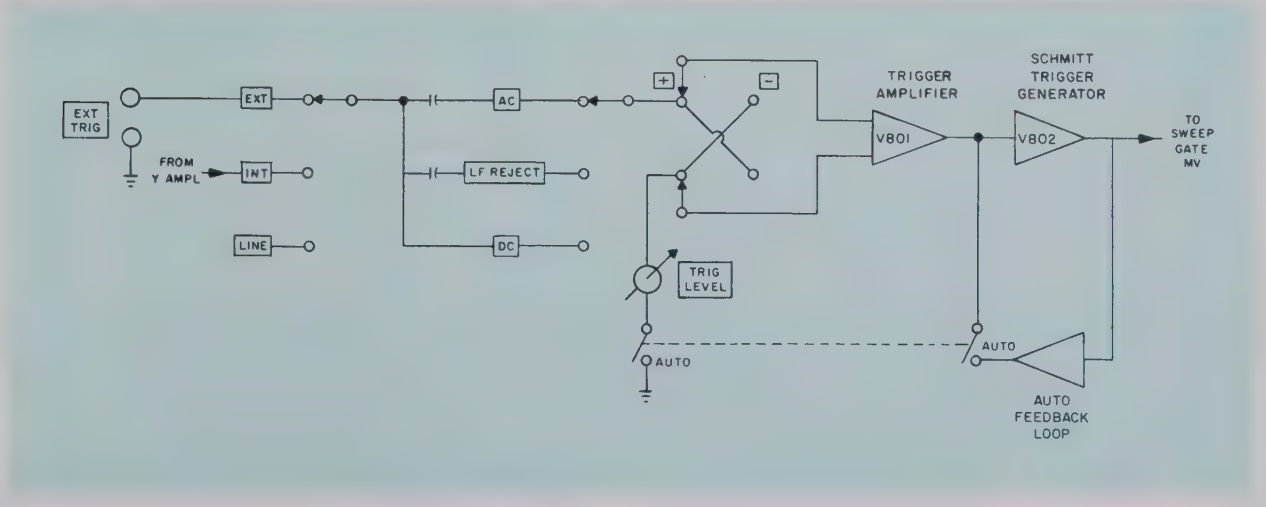


Figure 2-1. Trigger Amplifier, Functional Block Diagram

The Trigger LEVEL control is used to select the level of the triggering point for all settings of the Trigger SLOPE switch. When the Trigger LEVEL control is rotated fully clockwise to AUTO, the sweep is self-triggered in the absence of a triggering signal. As you rotate the control away from the AUTO position, the automatic sweep feature will cease. Continued rotation of this control will permit the operator to adjust the triggering level of the pattern within the limits specified in Section 1.

c. Schmitt Trigger Generator and Auto Triggering

The Schmitt Trigger Generator is essentially a regenerative amplifier signal level selector. It consists of a two-stage amplifier V802A and V802B, having a dc plate-to-grid coupling from A to B amplifier and dc cathode-to-cathode coupling. The circuit has two stable states: the A side conducting, the B side at cutoff; the B side conducting, the A side at cutoff. The transition from one state to the other is abrupt, producing fast rise and fall times from each side of the circuit.

The dc voltage applied to the grid of V802A determines which state the circuit will be in. Assume operation as follows: V802A is conducting and V802B is at cutoff. V802B will remain at cutoff until the amplitude of a positive-going signal applied to its grid reaches the threshold level of conduction. When this threshold level is exceeded, an abrupt transition from cutoff to full conduction will occur in V802B. Simultaneously, V802A will promptly stop conducting. V802A and V802B will revert to their original condition when the amplitude of the initiation signal falls slightly below the threshold level of conduction for V802B.

In general, the threshold voltage is higher when moving the grid in a positive direction, and lower when moving the grid in the negative direction. The two different voltage levels are called the "upper and lower hysteresis limits" of the Schmitt Trigger Generator. The hysteresis offset basically represents the input peak-to-peak voltage sensitivity of the trigger system.

The initial A-side grid level can be positioned anywhere inside or outside of the hysteresis area, thus establishing the input voltage required to change the state of V802A. The steady state grid bias of V802A is normally determined by the Trigger LEVEL control setting.

When the Trigger LEVEL control is set to AUTO, the trigger amplifier is ac coupled to the input grid of the Schmitt Trigger Generator through C8006, and the feedback resistor R8019 is connected between the grids of the Schmitt Trigger Generator. This causes V802A and V802B to flip back and forth yielding about 50 pulses per second in the AUTO position. Thus, a horizontal reference trace will appear on the screen even in the absence of an input signal.

2-3. SWEEP CIRCUIT DESCRIPTION (Figure 2-2)

a. Sweep Gate Multivibrator

The output from the Schmitt Trigger Generator is differentiated by C8101 and R8101 and applied to the grid of V804A through turn-on diode CR8101.

The dc coupled bistable multivibrator V804A and V804B initiates the formation of the sweep after receiving a negative trigger from the Schmitt Trigger Generator.

Diode CR8101 and the lockout circuit hold off subsequent triggering signals until after the sweep is completed. In the quiescent state, V804A is conducting and V804B is at cutoff. V804A forms a positive gate while V804B forms a negative gate during the forward sweep interval.

CR8101 performs two functions: 1) it serves as a low-capacitance coupling diode to couple the negative trigger from the Schmitt Generator to initiate the sweep, and 2) it serves as a high-back impedance diode to decouple the Trigger Generator from the sweep gate multivibrator. After the bistable multivibrator has been triggered, it will revert to its original state as determined by the setting of the LENGTH adjustment R8133.

b. Saw Generation

The saw generator is of the Miller "run-up" type V806. The negative output developed at the plate of V804B is applied to the plates of the disconnect diodes V805A and V805B. The anode voltages of these diodes are now below their cathodes, and the diodes no longer conduct. This action removes the restraint imposed on the sweep-charging network and now permits the selected sweep capacitor to charge linearly through the associated resistance network.

When the grid of the Miller integrator moves negatively, the plate voltage rises positively carrying the saw cathode-follower grid, cathode (V803B) and timing capacitor in the same direction. Thus, the positive voltage swing on the opposite side of the timing capacitor tends to prevent the grid side from swinging negatively. It also increases the voltage to which the timing capacitor is trying to charge. The net result is to *straighten out* the charging curve (sweep voltage) by maintaining a constant current flow in the capacitor.

Since the grid of V806 remains at a constant potential within a small fraction of a volt, the current through the charging resistor remains constant and the sweep timing capacitor thus charges at a constant rate. The resulting linear sawtooth waveform is applied to the horizontal deflection system.

The PULL 10X MAG control provides a calibrated magnification of the sweep about the screen center by a factor of 10. Any portion of the expanded display may be observed by adjusting the POSITION control.

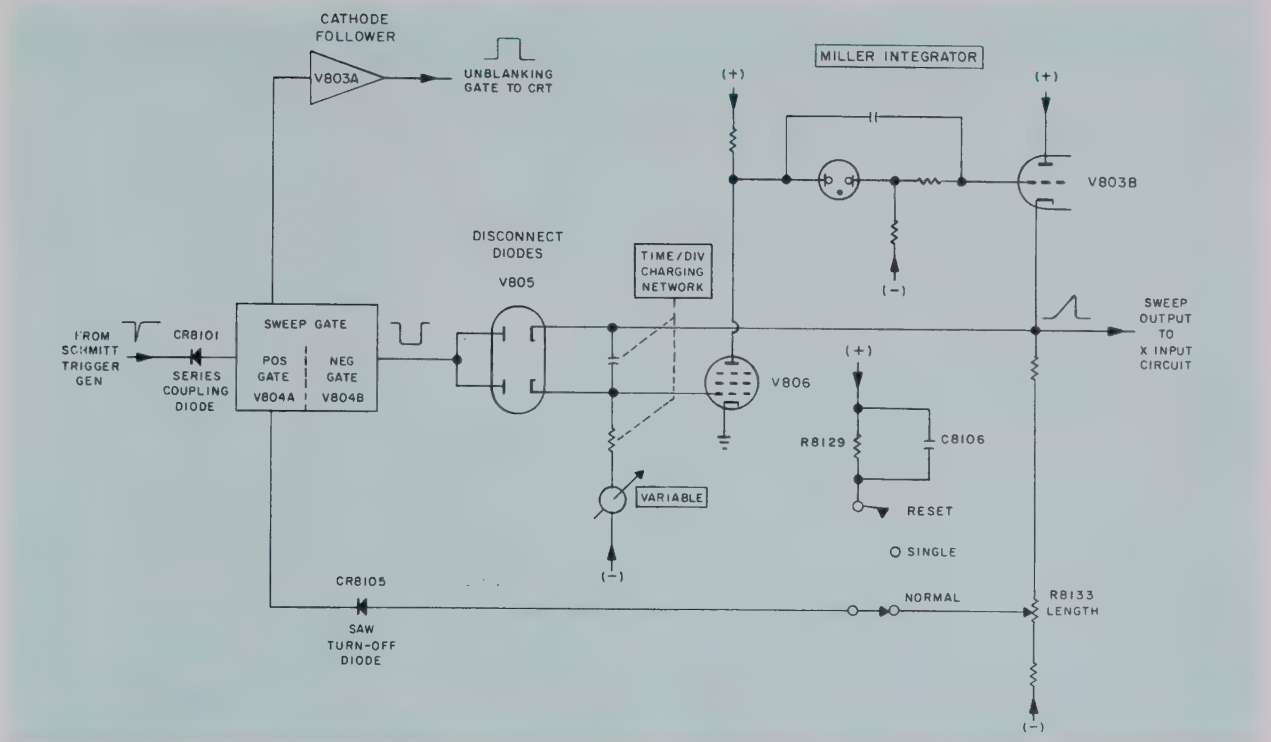


Figure 2-2. Sweep Generator, Simplified Block Diagram

When a Trigger Mode switch is set to SINGLE, the saw turn-off diode CR8105 is disconnected from the LENGTH potentiometer R8133. Thus only a single trace will now sweep across the screen when the sweep is triggered. At the end of its travel, the beam will rest off screen because the sweep gate multivibrator is locked in this position. To reset or rearm the sweep, push the Trigger Mode lever switch to the momentary contact RESET position. Refer to the Operating Instructions section for application of this technique.

c. Sweep Length

The sweep length, or the total duration of the sweep for any given sweep rate is determined by the setting of the Sweep LENGTH adjustment R8133. A portion of the positive sawtooth voltage is fed back to the saw turn-off diode CR8105. If the Sweep LENGTH potentiometer is properly set, diode CR8105 will conduct when the positive-going excursion of the sawtooth has travelled 10.5 to 11 divisions on the screen. This positive peak signal will then be conducted through diode CR8105 to the grid of V804A. Upon receiving this positive pulse, the sweep gate multivibrator will revert rapidly to its original state with V804A conducting and V804B at cutoff. The positive step from the plate of V804B returns the disconnect diodes V805A and V805B back to their conducting state thus discharging the timing capacitors. The Miller circuit now returns to its quiescent level and is ready for the next trigger after the lockout time interval is completed.

d. Lockout Circuit

The lockout circuit prevents the sweep gate multivibrator from being triggered until the sweep retrace interval has reverted to the quiescent base level. The sweep does not retrace in zero time since the clamping of the Miller integrator timing capacitor is accomplished with a diode switch having a small impedance. The timing circuit discharge (saw retrace) takes longer than the flipping of the sweep gate multivibrator. Consequently, the trigger excitation pulses must be held off to prevent the formation of a new saw during the retrace interval of the preceding saw. This last or preceding sawtooth waveform must be permitted to retrace completely to its quiescent base which re-establishes the beam to the left-hand side of the CRT screen. This is accomplished by holding the cathode of the series-triggering diode CR8101 at a suitable positive voltage for a given period after the completion of the sweep.

During the forward sweep interval, a portion of the positive gate voltage is fed back through R8103 to charge the lockout capacitor through coupling diode CR8102.

During the return-trace interval, diode CR8102 is cut off and the lockout capacitor is discharged through R8104. The sweep gate multivibrator will not reset until the appropriate lockout timing capacitor has been discharged. The value of this capacitor is chosen to give lockout beyond the time that the sweep has returned to rest at its initial starting point. The duration of the lockout interval is determined by the sweep charging time constant and the Miller integrator clamp. Consequently, the TIME/DIV switch must also change the lockout circuit hold-off timing capacity. This technique prevents additional triggers from energizing the sweep during retrace interval.

The trigger coupling diode CR8101 prevents triggers from disturbing the sweep gate multivibrator during all of the sweep-forward interval and the lockout circuitry during the retrace interval.

e. Unblanking

The cathode-ray tube employed in this oscilloscope has two additional beam deflecting plates which cut off the electron beam independently of the control grid. Beam control pulses (trace brightening and retrace blanking pulses) can easily be dc coupled since these beam deflection plates are electrically close to ground. In conventional circuits these pulses must be coupled to a high-potential control grid of the CRT.

The extra beam deflection plates are controlled by the sweep gate multivibrator V804. A positive gate is developed at the plate of V804A and is coincident with the sweep forward time. This pulse is applied to the beam deflection plate of the cathode-ray tube through cathode follower V803A. Hence the display is visible only during the forward sweep interval and is blanked during the retrace and lockout interval.

When the TIME/DIV switch is set to EXT INPUT, one side of the sweep gate multivibrator is ungrounded thus disabling the sweep circuit and turning on the beam. The horizontal deflection amplifier may now be set up to receive external signals.

2-4. HORIZONTAL DEFLECTION CIRCUIT DESCRIPTION (Figure 2-3)

The TIME/DIV switch provides for the selection of time base or external signals for horizontal deflection. External signals may be applied to the EXT INPUT terminal for single-ended input. The time base signal is obtained from the sweep circuit and is applied to the horizontal deflection amplifier when the oscilloscope is set up for internal sweep.

The POSITION control supplies a manually adjustable dc voltage to the grid of V820B for positioning the display on the screen. For the Type 766 Series, a PATTERN POSITIONING control is mounted on the front panel of the Main Frame and is electrically

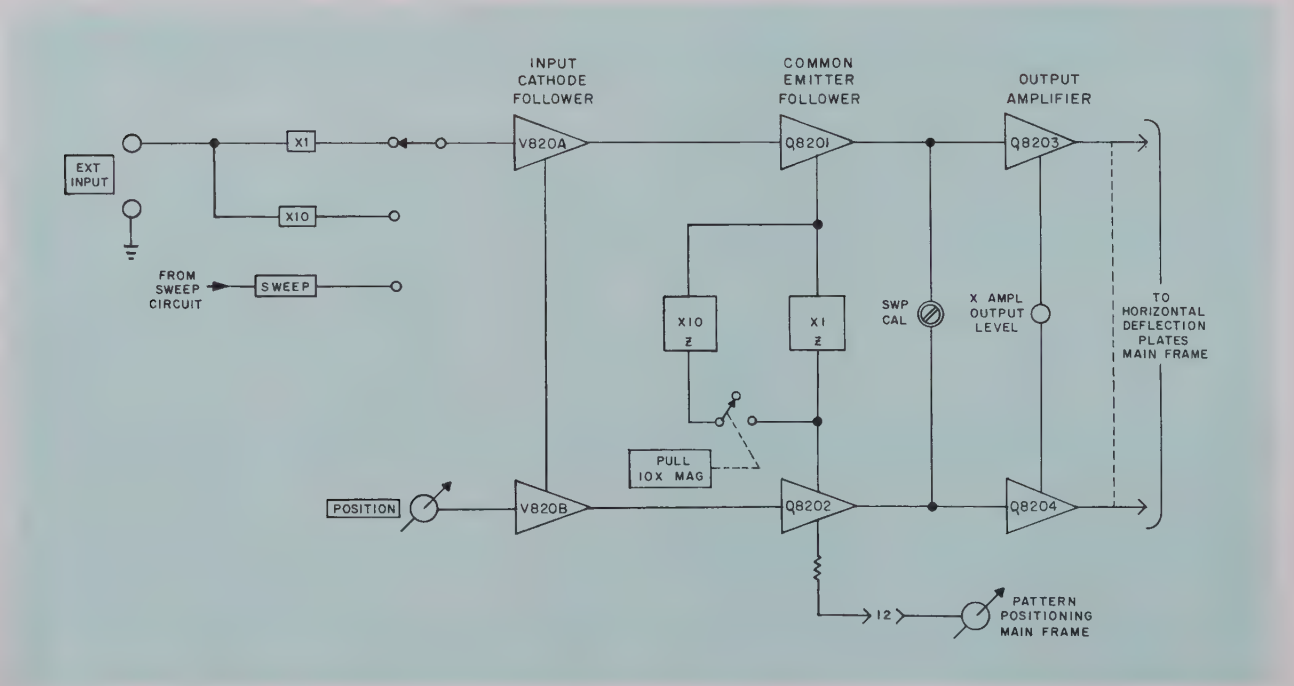


Figure 2-3. X Deflection Amplifier, Functional Block Diagram

coupled to the POSITION control of both the X and Y Plug-ins. This feature permits positioning the entire display in the horizontal and vertical directions on the screen via use of the single joystick control.

When the TIME/DIV switch is set up for EXT INPUT, the externally applied signal may be attenuated by factors of 1 or 10. These two fixed ranges labelled 1X and 10X on the front panel, provide sensitivity of greater than 1 volt to greater than 10 volts/div. The 10 to 1 fixed expansion extends the basic range from greater than 0.1 volt to greater than 10 volts/div.

The PULL 10X MAG control also provides continuous adjustment from 1 to 10 times for magnification of the internal time base or of external EXT INPUT signals.

The X AMP LEVEL potentiometer R8235 is provided to set the X deflection plate average potential equal to the Y deflection plate average potential.

The EXP BAL potentiometer R8229 provides for equal expansion of the trace from screen center.

The horizontal deflection plates are driven directly from the transistorized amplifier Q8203 and Q8204.

2-5. TIMING DIAGRAM (Figure 2-4)

A timing diagram of the Type 74-14 Time Base Plug-in shows waveforms at critical points in the circuit and in proper relative time relationship. In addition, a capsule description of each waveform is provided.

2-6. GAINING ACCESS TO CHASSIS

Since the plug-in is not contained in its own dust cover, most of the components are readily accessible when the plug-in is removed from the Main Frame. To gain access to the chassis, simply unscrew the knurled thumbscrew at center bottom of unit and pull it free of the Main Frame.

WARNING

WHEN THE PANELS OR PLUG-INS ARE REMOVED FROM THE INSTRUMENT FOR SERVICING, EXERCISE CAUTION WHILE THE POWER IS ON. The lower-voltage busses are potentially more dangerous than the cathode-ray tube potential because of the high-current capabilities and large filter capacitors employed in these supplies. When you reach into the instrument with one hand while it is turned on, do not grasp the metal frame with the other hand. If possible, stand on an insulated floor and use insulated tools. It is advisable to ground the third lead in the power cord whenever the instrument is in use.

2-7. REMOVAL AND REPLACEMENT OF PARTS

If it is necessary to order a replacement component from the factory, always give the Type Number and Serial Number of the instrument. Before ordering parts for in-warranty replacement, or purchasing them for out-of-warranty replacement, be sure to consult the Parts List in this manual. The Parts List gives the values, tolerances, ratings, and the factory part number for all electrical components used in the instrument. This will help to expedite service.

Since your instrument left the factory, some of the parts may have been superseded by improved components. In such cases, the part numbers of these new components will not be listed in your Parts List. However, if you order a part from the factory and it has been superseded by an improved component, the new part will be shipped in place of the part ordered.

It is the aim of the Fairchild organization to make available the most reliable commercial oscilloscopes within the state of the art and to provide services which will help the user to rapidly restore any of our equipment to its specified performance. Your local Field representative maintains a limited number of spare parts. Also the factory may be asked to air-ship replacement parts on a rush basis.

The procedure for replacing most parts in this instrument is obvious, therefore specific instructions for their removal are not required.

Note: Be sure and replace the beryllium oxide insulating washers (they serve as heat sinks) on the transistors that require them. Always grease these heat sinks with Dow Corning silicon grease for optimum heat transfer.

2-8. SERVICING HINTS

General maintenance and trouble shooting information is given in the Type 765 Series Oscilloscope Instruction Manual. In the following discussion, it is assumed that you have already read that information and have definitely isolated a trouble in the Time Base Plug-in unit.

In trouble shooting a plug-in unit, it becomes necessary to determine if the defect is in the plug-in or in the Main Frame of the oscilloscope. The quickest and easiest way of isolating the trouble is to substitute another plug-in unit and determine if the same trouble persists. If the trouble continues after substitution, it can be safely assumed that the defect is in the Main Frame.

Although this is a complex electronic instrument, it may be localized to the following basic circuits:

1. Trigger Circuit
2. Time Base Circuit
3. Horizontal Deflection Amplifier

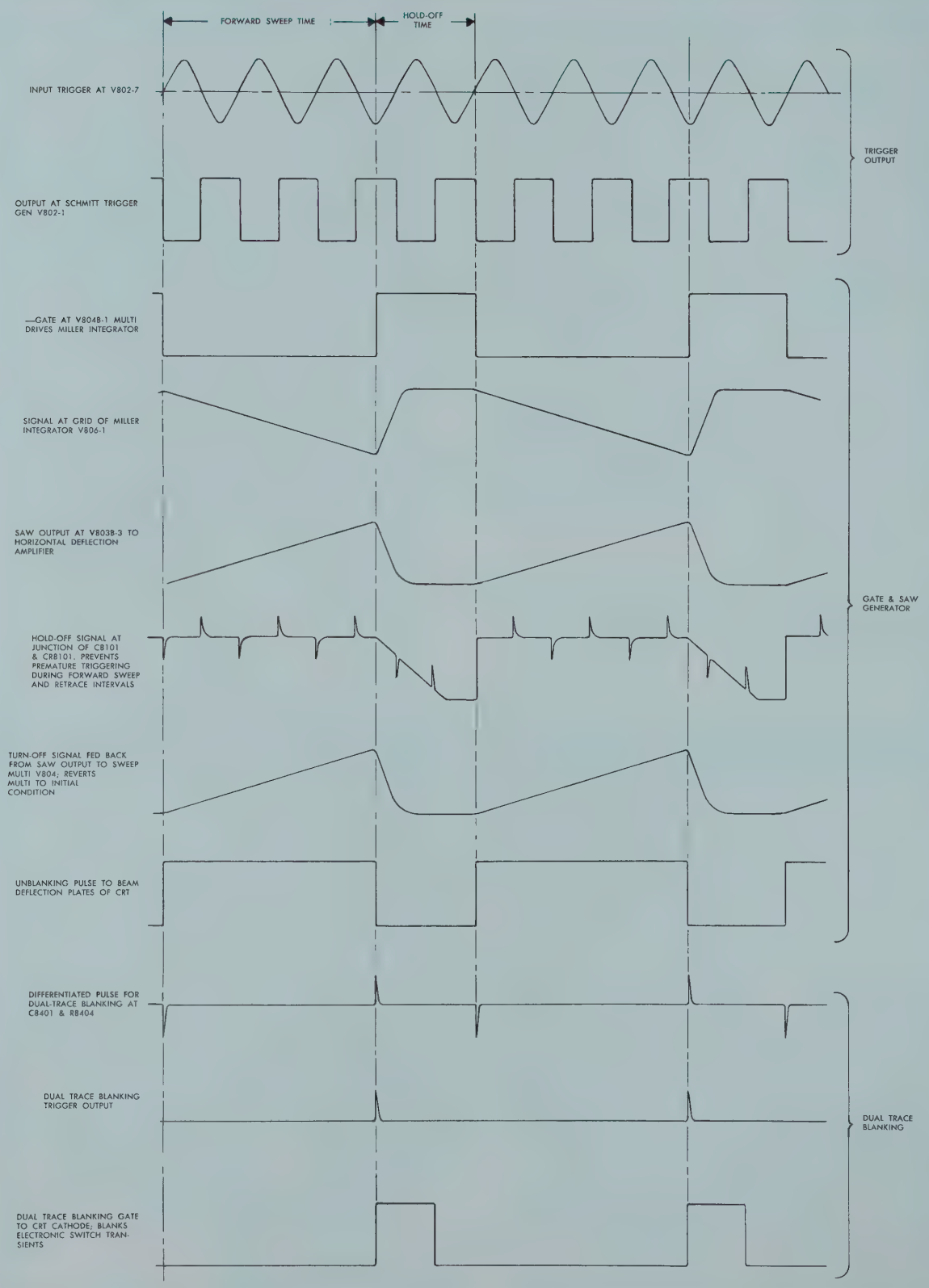

FORWARD SWEEP TIME
HOLD-OFF TIME
INPUT TRIGGER AT V802-7
OUTPUT AT SCHMITT TRIGGER GEN V802-1
TRIGGER OUTPUT
—GATE AT V804B-1 MULTI DRIVES MILLER INTEGRATOR
SIGNAL AT GRID OF MILLER INTEGRATOR V806-1
SAW OUTPUT AT V803B-3 TO HORIZONTAL DEFLECTION AMPLIFIER
HOLD-OFF SIGNAL AT JUNCTION OF C8101 & CR8101. PREVENTS PREMATURE TRIGGERING DURING FORWARD SWEEP AND RETRACE INTERVALS
TURN-OFF SIGNAL FED BACK FROM SAW OUTPUT TO SWEEP MULTI V804; REVERTS MULTI TO INITIAL CONDITION
GATE & SAW GENERATOR
UNBLANKING PULSE TO BEAM DEFLECTION PLATES OF CRT
DIFFERENTIATED PULSE FOR DUAL-TRACE BLANKING AT C8401 & R8404
DUAL TRACE BLANKING TRIGGER OUTPUT
DUAL TRACE BLANKING
DUAL TRACE BLANKING GATE TO CRT CATHODE; BLANKS ELECTRONIC SWITCH TRANSIENTS

Figure 2-4. Timing Diagram, Type 74-14 Time Base

Whenever trouble occurs in this instrument, first try to localize it to one of these basic circuits.

There is no simple way of locating troubles. An understanding of the functions of the circuits is the best help (see Circuit Description in this section). With an understanding of the circuits, you will be able to make a reasonable assumption at the general source of troubles from their symptoms.

As an aid in trouble shooting this unit, refer to the simplified functional block and timing diagrams shown in Figures 2-1 through 2-4, and of the schematics located at the rear of this Instruction Manual.

To keep electronic units operating at top performance, it is desirable to check the equipment at regular intervals. How often it is checked will depend on the installation and conditions of operation. In general, portable units moved about constantly will require more frequent service than units fastened down permanently. For these regular checks, clean all dust and dirt from the unit using a light air blast or soft brush.

In the event of improper equipment performance, the following suggestions are recommended:

1. The Type 4294 Extension Cable for remote operation of the plug-in from the oscilloscope is available as an accessory. This plug-in extender will be helpful for routine maintenance and recalibration. Do not use this extension for HF alignments; instead, remove the Main Frame side cover.

2. Try to set up the oscilloscope as depicted in Figure 1-4 entitled "Initial Setup of Type 74-14 Time Base" in Section 1 of this Instruction Manual.

3. Localizing the trouble is made easier by use of a Test Oscilloscope to check waveforms. Waveforms are shown at key points on the over-all schematics which are located at the rear of this manual. Both the amplitude and time duration are given. Use a high impedance 10:1 Passive Attenuator Probe while trouble shooting (Fairchild Type 4290 Series).

4. Maintain a high quality of workmanship. Use a clean bench and soldering iron; keep solder joints smooth and bright; do not overheat any component while soldering. Use heat sinks while soldering semiconductors. The use of a 30-watt iron such as a Hexacon Type 26S is recommended.

5. When using the accessory probes or adapters, be sure the trouble is *not* originating in the accessory before suspecting the oscilloscope itself.

6. Once the defective stage has been localized, the component or components causing the trouble can be located by tube and component substitution or by voltage measurements. Key voltage measurements are shown on the overall schematics at the rear of this manual.

2-9. PREVENTIVE MAINTENANCE

This unit is a stable instrument that will provide many hours of trouble-free operation. However, to insure the reliability of measurements, we suggest that you recalibrate the instruments after each 500 hours of operation or every six months if used intermittently. Also, the calibration of a unit should always be checked and adjusted as necessary after the repair or replacement of any component in the unit. The complete adjustment procedure for this instrument is given in this section of the Instruction Manual.

Note: The regulated power supplies on the Main Frame should always be checked before calibrating any part of the instrument.

2-10. TEST EQUIPMENT REQUIRED FOR SERVICE ADJUSTMENTS

a. Introduction

The adjustments outlined in the following paragraphs are based on the test procedure followed at the factory.

Normally only periodic adjustment of the SWP CAL control will be necessary. The procedure outlined in this manual should be followed. The attenuators are factory aligned and should not be touched unless there is a positive indication that they require adjustment.

All adjustments should be made at mid-line voltage, 115V/230V, ±2%.

b. Test Equipment Required (Equivalent may be substituted)

Equipment	Description
Oscilloscope	Fully certified and tested Type 766H Series Main Frame
Y Plug-In	Type 76-03 or equivalent
Differential Voltmeter	John Fluke Model 825A; 0.1 to 500 volts, 0.1% accuracy
Attenuator Probe	Fairchild Type 4290 Series; 10:1 and terminated in BNC Type connector; 10 megohms, 10 pf input
Square Wave Generator	Fairchild Type 791
Signal Generator	Hewlett-Packard Type 650A with 600-ohm termination
Volt-Ohmmeter	Simpson Model 260, 20,000 ohms/volt
Alignment Tools	Fairchild Type 7013 Tool Kit
Time-Mark Generator	Fairchild Type 781
BNC to BNC Connectors and Cable (42")	Fairchild Type 7082

Turn on the power and allow 5 minutes of warmup time. In the meantime, preset front-panel controls as indicated:

Control	Setting
Trig LEVEL	AUTO
Trig MODE	NORMAL
TRIGGER SOURCE	LINE
TRIGGER COUPLING	AC
TRIGGER SLOPE	+
TIME/DIV	5 mSEC
VARIABLE	CAL (fully cw and pushed in)
VOLTS/DIV (Y Plug-in)	OFF

2-11. X OUTPUT LEVEL ADJUSTMENT (R8235)

The X OUTPUT LEVEL ADJ potentiometers are provided to set the X deflection plate average potential equal to the Y deflection plate average potential.

1. Set TIME/DIV switch to EXT INPUT 1X
2. Temporarily short the horizontal deflection plate leads together.
3. Connect the John Fluke Voltmeter between the now common collectors to ground.
4. Adjust the X AMPL LEVEL potentiometer R8235 for 99 volts.
5. Disconnect the meter and the X deflection plate short.

2-12. EXPANSION BALANCE ADJUSTMENT (R8229)

When this control is properly adjusted, the display on screen will expand equally about screen center for either the internal time base or externally applied signals. To adjust, proceed as follows:

1. Set Y VOLTS/DIV switch to CAL and TIME/DIV switch to EXT INPUT 10X.
2. Temporarily ground the EXT INPUT binding posts.
3. Switch from 1X to 10X magnification several times while adjusting the X POSITION control to locate a point on screen where trace appears to be balanced.
4. Adjust the EXP BAL potentiometer R8229 to center the trace.
5. Repeat steps 3 and 4 until there is no depositioning when switching from 1X to 10X magnification.
6. Remove the temporary ground from the EXT INPUT binding posts.

2-13. SWEEP LENGTH ADJUSTMENT (R8133)

The Sweep LENGTH potentiometer is provided so that the trace may be adjusted to display a horizontal scan of 10 to 11.5 divisions when oscilloscope is set up for calibrated unexpanded sweep.

1. Set up the oscilloscope to obtain a normal calibrator display on the screen.
2. Adjust Sweep LENGTH potentiometer R8133 until the display occupies 10.5 div of horizontal deflection.

2-14. FAST SWEEP CALIBRATION ADJUSTMENT (C8302)

1. Apply a 1-microsecond time-marker signal from a Fairchild Type 781 Generator through a properly terminated cable to the Y Input connector.
2. Adjust the VOLTS/DIV switch to give the display a vertical amplitude of about 4 divisions.
3. Set TIME/DIV switch to 1 μSEC and push in and rotate fully clockwise the VARIABLE control.
4. Using an insulated screwdriver, adjust trimmer C8302 for one pulse per division.

Note: A tabulation check of all sweep ranges is shown in the *Sweep Check Calibration Chart* located in Section 3 of this Instruction Manual.

2-15. EXTERNAL INPUT TRIMMER ADJUSTMENT (C8207)

1. Replace the Plug-in Amplifier in the Y cavity with a tested Time Base Plug-in unit. This unit is then set up to obtain a vertical sweep. (Set up for 0.1 millisecond.)
2. Connect sync output from a Fairchild Type 791 Square Wave Generator to the EXT TRIG connector of the Time Base installed in the Y cavity.

Note: Unless otherwise noted, the test procedure for the balance of this setup pertains to the Time Base unit inserted in the X cavity.

3. Set TIME/DIV switch to EXT INPUT 1X and pull out the VARIABLE control for 10X MAGnification.
4. Apply a 10 Kc square wave signal from the Fairchild Type 791 Generator through a properly terminated cable to EXT INPUT connector.
5. Set amplitude of the display for approximately 8 divisions.
6. Adjust trimmer C8207 for optimum square wave response.

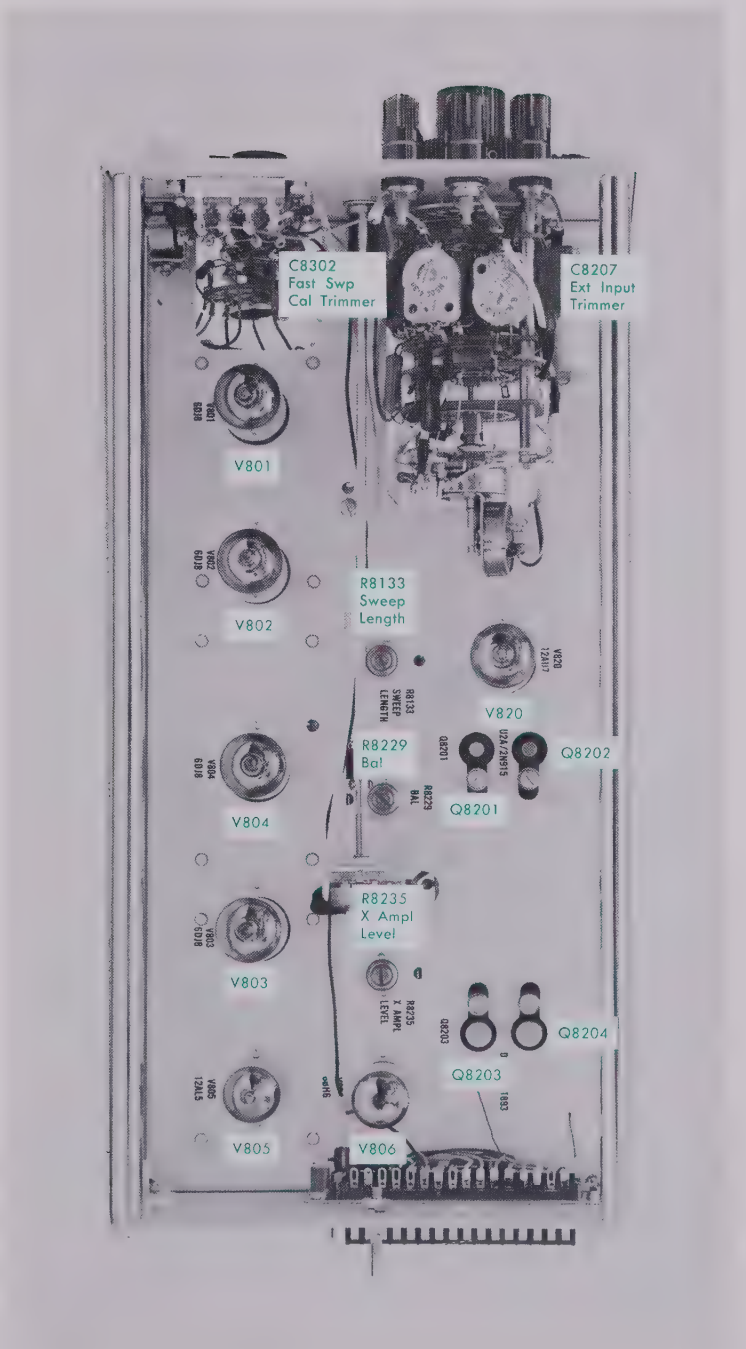


Figure 2-5. Right Side View Showing Transistors, Tubes and Adjustments

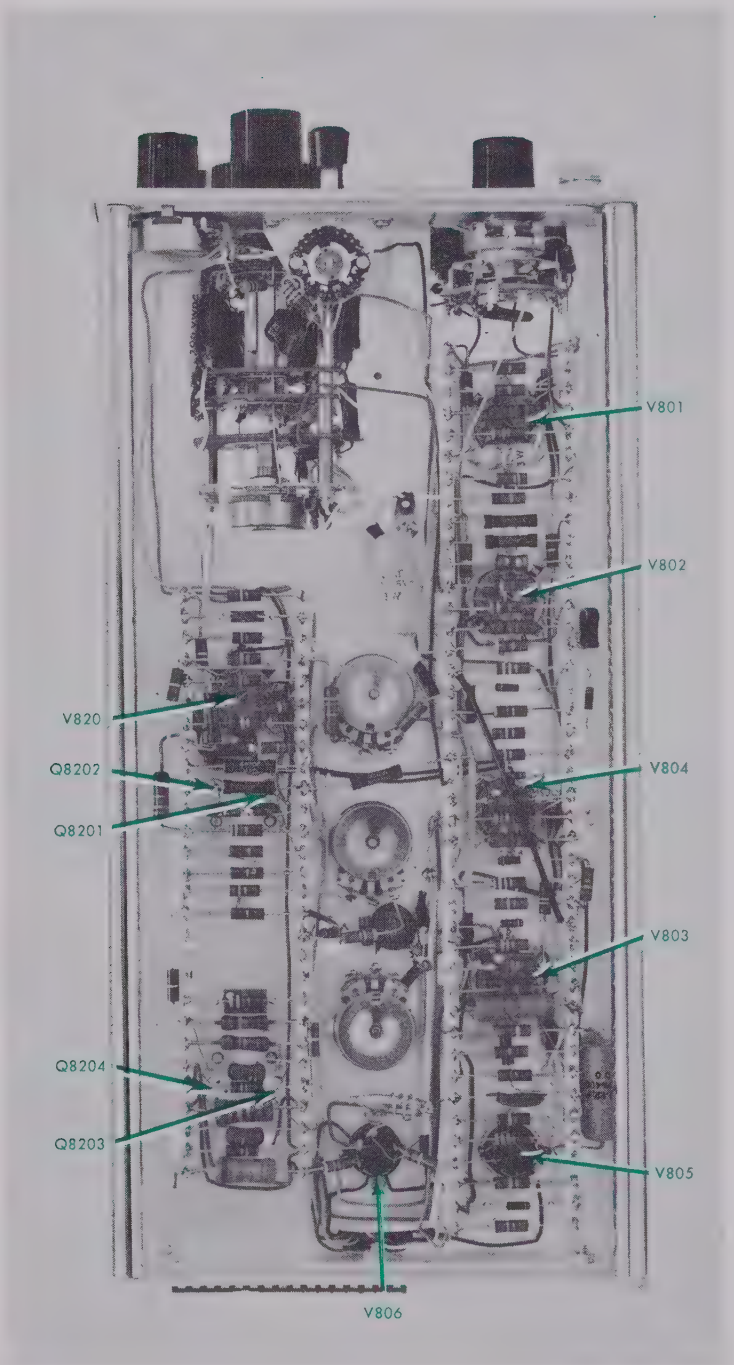


Figure 2-6. Left Side View Showing Transistors and Tubes

SECTION 3
PERFORMANCE ASSURANCE TEST

3-1. MAINTENANCE CHECK TO ASSURE PERFORMANCE

The tests described in the paragraphs to follow should be performed by Instrument Test Departments and Maintenance Laboratories to certify proper performance. These tests are divided into sections for simplification and to assist those test groups where complete checking is not mandatory, or where all test equipment is not available. Refer to Section 2, paragraph 2-10 for list of test equipment required.

NOTE

All tests are performed with a representative Type 765 Series Main Frame Oscilloscope and a Y Amplifier Plug-in. Both of the plug-in units must be normalized to the Main Frame before starting tests. This is accomplished by adjusting the front-panel screwdriver SWP CAL and GAIN CAL controls as described in the appropriate Plug-in Instruction Manuals.

This plug-in module has been thoroughly tested and aged at the factory. Nevertheless, rough shipment, extreme environments, or long idle periods may necessitate minor adjustments of the controls. Hence it is suggested that the certifying engineer try the recommended adjustments not only for recentering the controls, but also to ascertain their range and to familiarize himself with this precision instrument. If, after performing all the tests outlined in this Section, the instrument will not perform to specification, the assistance of the local Fairchild Field Engineering representative should be requested.

3-2. INITIAL SETUP OF TYPE 74-14 (Figure 3-1)

If the controls are set exactly as shown and performed in the sequence indicated in Figure 3-1, three cycles of the calibrator signal will be displayed on screen. The procedure just given is a good, over-all check of this plug-in module.

3-3. TRIGGERING CIRCUIT CHECKS

a. Check Trigger Sensitivity

1. Set Trigger LEVEL control to AUTO, and Trigger SOURCE switch to EXT.
2. Connect a Fairchild Type 791 Square Wave Generator to EXT TRIG connector and in parallel to the input of the Y Plug-in. A trace should appear.
3. Set the Generator for a frequency of 300 Kc and an output of 400 millivolts; a trace should appear.
4. Turn Trigger LEVEL control out of the AUTO position and continue to adjust until the trace reappears. If trace does not reappear, perform routine maintenance on the trigger circuitry.

b. Check Triggering Slope (S803)

1. Set Trigger LEVEL control to AUTO, Trigger SOURCE switch to INT and Trigger SLOPE switch to +.
2. Display the calibrator signal on the screen. The pattern must lock on positive-going signal.
3. Change the Trigger SOURCE switch from plus to minus; the leading edge of the first cycle should invert.

3-4. CHECKING SWEEP CALIBRATION

1. Connect a Fairchild Type 781 Time-Mark Generator to the Input connector of the Y Plug-in through a properly terminated cable.
2. Sweep accuracy is checked by counting the positive peaks in the centered 8-division portion of the CRT scale. Make sure the UNCAL lamp is off and refer to the accompanying Sweep Check Calibration Chart for additional data. All measurements indicated in this chart should fall within ± 0.2 division of the 9-division marking.

3-5. CHECKING SINGLE SWEEP

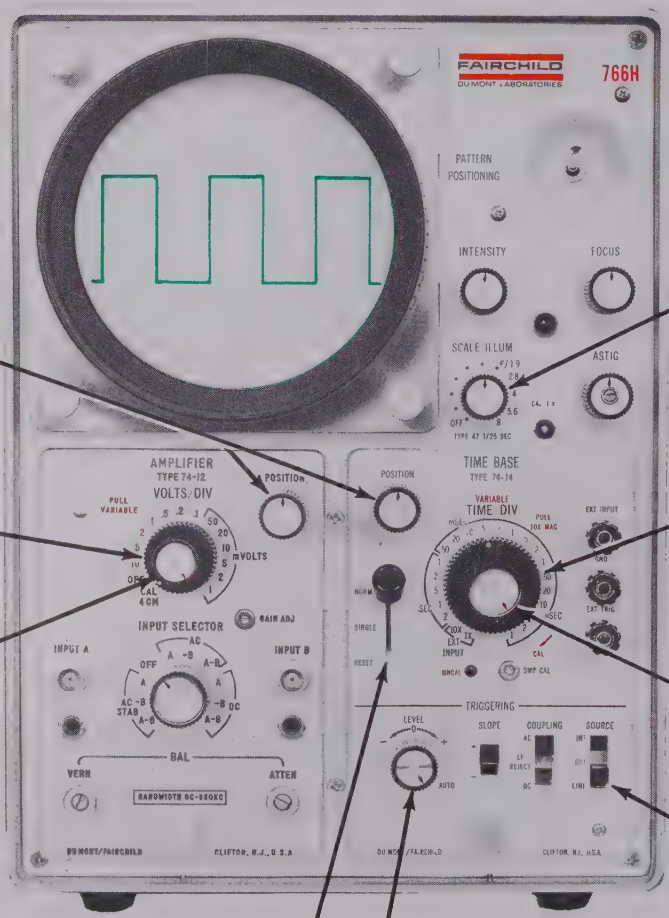
1. Adjust the instrument to obtain the calibrator signal on the screen.
2. Set Trigger SOURCE switch to LINE and Sweep Mode switch to SINGLE. The display on the screen should disappear and some glow may appear on the right side of the screen.
3. Set Mode switch to RESET and observe that only one sweep occurs. One excursion of the trace should occur each time the Mode switch is pushed to RESET. The screen glow should disappear when the sweep is reset.

3-6. CHECK OPERATION OF VARIABLE SWEEP CONTROL

1. Set TIME/DIV switch to 1 msec and push in VARIABLE control and turn fully clockwise.

To obtain the calibrator display, set the controls exactly as shown and perform the numbered steps in sequence.

Use the same procedure when difficulty is experienced when obtaining a display. This will eliminate "cockpit" troubles due to misalignment of controls.



Set ASTIG, FOCUS, & INTENSITY controls to center of range

1 Rotate clockwise to turn on the oscilloscope

Set POSITION controls to center of range 6

Set outer knob (VOLTS/DIV) to CAL 7

Push in inner knob (VARIABLE) and rotate it fully clockwise 8

2 Set outer knob (TIME/DIV) to 5 mSEC

3 Push in inner knob (VARIABLE) and rotate it fully clockwise. Note that UNCAL lamp is off

4 Set TRIGGERING switches to +, AC, LINE

Readjust INTENSITY, FOCUS & ASTIG controls for a sharp pattern

Set to NORMAL 9

5 Rotate clockwise to AUTO until switch is actuated (click is heard)

NOTE

The front-panel screwdriver BAL controls on the Y Plug-in must be properly adjusted to obtain an on-screen trace. See the appropriate Y Plug-in Instruction Book

Figure 3-1. Initial Setup of Type 74-14 Plug-In

2. Connect a Fairchild Type 781 Time-Mark Generator (set for 5msec) to Y Amplifier. Three pulse peaks should appear over 10 divisions in the CAL position. (UNCAL lamp is off.)

3. Rotate VARIABLE control fully counterclockwise. A minimum of nine pulse peaks should appear over 10 divisions.

Note: The UNCAL lamp must go on when the Sweep VARIABLE control is turned out of the CAL position.

3-7. X10 MAGNIFIER CHECK

1. Adjust instrument to display exactly 10 cycles of the internal calibrator signal.

2. Pull out VARIABLE knob for 10X MAGnification of the display. The center cycle of the calibrator waveform should now occupy the full screen.

3. Position the calibrator transition to screen center. If more than 12 divisions of positioning is required, the EXP BAL potentiometer R8229 requires adjustment. One cycle of the expanded calibrator display occupies 9.5 to 10.5 divisions; if it does not, X Amplifier maintenance is required.

SWEEP CHECK CALIBRATION CHART

TIME-MARK GEN set to	TIME/DIV set to	NUMBER OF POSITIVE PULSES*
1 μsec marker	1 μsec	9 timing markers
1 μsec marker	2 μsec	17 timing markers
5 μsec marker	5 μsec	9 timing markers
10 μsec marker	10 μsec	9 timing markers
10 μsec marker	20 μsec	17 timing markers
50 μsec marker	50 μsec	9 timing markers
100 μsec marker	0.1 msec	9 timing markers
100 μsec marker	0.2 msec	17 timing markers
500 μsec marker	0.5 msec	9 timing markers (2**)
1 msec marker	1 msec	9 timing markers
1 msec marker	2 msec	17 timing markers
5 msec marker	5 msec	9 timing markers
10 msec marker	10 msec	9 timing markers
10 msec marker	20 msec	17 timing markers
50 msec marker	50 msec	9 timing markers
100 msec marker	0.1 sec	9 timing markers
100 msec marker	0.2 sec	17 timing markers
500 msec marker	0.5 sec	9 timing markers
1 sec marker	1 sec	9 timing markers
1 sec marker	2 sec	17 timing markers

* Centered 8-division portion of scale
** Checking 10X sweep expansion

3-8. X AMPLIFIER RESPONSE CHECK

1. Set TIME/DIV switch to EXT INPUT 1X and push in the VARIABLE control.

2. Turn off the Y Amplifier.

3. Connect the Hewlett-Packard Type 650A Signal Generator to EXT INPUT connector and properly terminate in 600 ohms.

4. Set generator frequency to 10 Kc and adjust the output of the generator to give exactly 8 divisions of horizontal deflection on the screen.

5. Set generator frequency to 350 Kc. Do not touch any amplitude settings. The peak-to-peak amplitude on screen must be greater than 5.6 divisions. If this specification is not met, then X Amplifier calibration maintenance may be required.

3-9. DUAL TRACE TRIGGER CHECK (OPTIONAL)

This check is optional and is only required when a multitrace (dual trace etc.) electronically switched Y Amplifier Plug-in is to be used with the Type 74-14.

1. Preset front-panel controls as indicated:

Control	Setting
Trigger LEVEL	AUTO
Trigger Mode	NORM
Trigger SOURCE	LINE
Trigger COUPLING	AC
Trigger SLOPE	+
TIME/DIV	5 mSEC
VARIABLE	CAL (fully cw and pushed in)
VOLTS/DIV (Y Multi-Trace Plug-in)	CAL

2. Display the calibrator signal on two channels of the Multi-Trace Y Amplifier Plug-in.

3. Set Mode switch on Y Plug-in to ALT. The calibrator signal should be displayed stably on either channel.

4. Check that each trace may be smoothly positioned independently of the other.

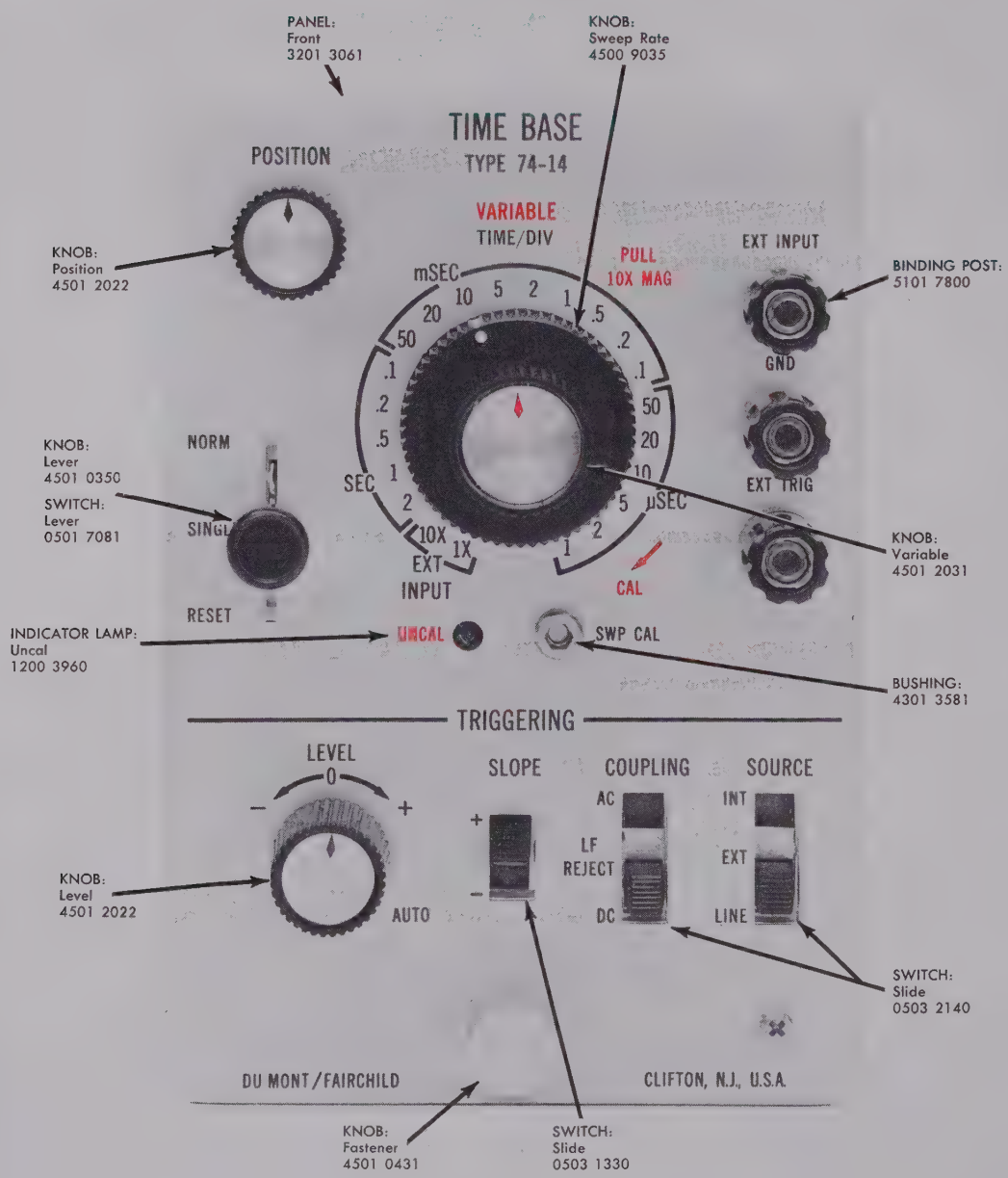


Figure 4-1. Front Panel Replaceable Parts

SECTION 4A
ELECTRICAL PARTS LIST AND SCHEMATICS

TYPE 74-14 TIME BASE PLUG-IN

CAPACITORS

Notes: 1. All capacitors are fixed, ceramic, and 500V unless otherwise specified; pf ($\mu\mu$f) denotes picofarads.

2. GMV denotes Guaranteed Minimum Value.

Symbol	Part Number	Description	Recommended Vendor Code	Type
C8001	0326 4520	1000 pf, GMV	ERC	831
C8002	0326 4550	2000 pf, GMV	ERC	831
C8003	0315 2000	100 pf, ±20%	EIA	
C8004 & C8005	0326 4640	0.01 μf, GMV	ERC	811
C8006	0326 7840	plastic, 0.047 μf, ±10%, 125V	AMX	C296AA
C8007	0315 2970	39 pf, ±10%	ERC	GPS 1331
C8101	0316 7470	47 pf, ±5%	ERC	
C8102	0326 8080	plastic, 0.22 μf, ±10%, 400V	AMX	C296AC
C8103 & C8104	0305 5100	mica, 51 pf, ±5%	EIA	
C8105	0326 4640	0.01 μf, GMV	ERC	811
C8106	0317 6610	mica, 270 pf, ±5%	EMC	DM20
C8200	0326 4520	1000 pf, GMV	ERC	831
C8201	0315 6990	10 pf, ±1 pf, 1000V	RMC	C
C8202 & C8203	0316 7160	3.3 pf, ±0.25 pf	ERC	NPO331
C8204	0326 4640	0.01 μf, GMV	ERC	811
C8206	0317 6690	mica, 560 pf, ±5%	EMC	DM20
C8207	0300 7790	variable, 1.5-7 pf	ERC	NPOTS2A
C8208	0326 4520	1000 pf, GMV	ERC	831
C8209	0317 6550	mica, 150 pf, ±5%	EMC	DM20
C8301	0314 2660	68 pf, ±5%	ERC	GPI-331
C8302	0326 8650	variable, 4-30 pf	ERC	TS2A
C8303	0326 8760	plastic, 0.86 μf, ±1%, 100V	GUD	355B
C8304	0318 5370	mica, 8514 pf, ±1%	EMC	
C8305	0319 9830	plastic, 0.0047 μf, ±20%, 400V	GUD	355E
C8306	0326 7900	plastic, 0.47 μf, ±10%, 125V	AMP	C296AA
C8307	0317 6580	mica, 200 pf, ±5%	EIA	
C8401	0315 4500	150 pf, ±10%, 1000V	RMC	JL

SEMICONDUCTORS

Symbol	Part Number	Description	Recommended Vendor Code	Type
CR8101 to CR8107	2600 6910	diode, FD841	FCI	

LAMPS

Symbol	Part Number	Description	Recommended Vendor Code	Type
E8101	1200 3960	glow, NE-2	GE	NE-2
DS8301	1200 3960	glow, NE-2 (UNCAL)	GE	NE-2

ELECTRICAL CONNECTORS

Symbol	Part Number	Description	Recommended Vendor Code	Type
J8001	5101 7800	binding post, black (EXT TRIG)	GRY	29
J8002	5101 7800	binding post, black (GND)	GRY	29
J8201	5101 7800	binding post, black (EXT INPUT)	GRY	29
P8001	0905 7340	receptacle, general purpose, male, 32 contacts	APH	26 159-32

TRANSISTORS

Symbol	Part Number	Description	Recommended Vendor Code	Type
Q8201 & Q8202	2600 7070 2600 7050	DU #2A alternate 2N915	FCI	
Q8203 & Q8204	2600 7270 2600 7250	DU #6A alternate 2N1893	FCI	

RESISTORS (8000)

Note: All resistors are fixed, composition, ±5%, ½W, and values in ohms unless otherwise specified; K = thousand, M = million

Symbol	Part Number	Description	Recommended Vendor Code	Type
R8001	0203 1890	10K, ±10%	ALB	EB
R8002	0203 0960	100K	ALB	EB
R8003	0203 1200	1M	ALB	EB
R8004	0203 1040	220K	ALB	EB
R8005	0203 1890	10K, ±10%	ALB	EB
R8006	0234 8540	film, 24K	CGW	C20
R8007	0203 1650	100, ±10%	ALB	EB
R8008	0203 0690	7.5K	ALB	EB
R8009	0203 1650	100, ±10%	ALB	EB
R8011	0234 9400	film, 30K, 1W	CGW	C32
R8012	0203 0890	51K	ALB	EB
R8013	0107 2742	variable, 500K, ¼W (TRIG LEVEL)	ABD	
R8014	0203 0890	51K	ALB	EB
R8015	0203 0880	47K	ALB	EB
R8016	0203 0640	4.7K	ALB	EB
R8017	0203 0880	47K	ALB	EB
R8018	0203 1650	100, ±10%	ALB	EB
R8019	0203 1270	2M	ALB	EB
R8021	0203 0570	2.4K	ALB	EB
R8022	0236 7560	film, 90.9K, ±1%	CGW	N20
R8023	0236 7600	film, 100K, ±1%	CGW	N20
R8024	0203 1650	100, ±10%	ALB	EB
R8025	0203 0600	3.3K	ALB	EB
R8026	0234 9360	film, 20K, 1W	CGW	C32

RESISTORS (8100)

Symbol	Part Number	Description	Recommended Vendor Code	Type
R8100	0203 0520	1.5K	ALB	EB
R8101	0203 0640	4.7K	ALB	EB
R8102	0203 0890	51K	ALB	EB
R8103	0203 0810	24K	ALB	EB
R8104	0203 1050	240K	ALB	EB
R8105	0203 1670	150, ±10%	ALB	EB
R8106	0203 0520	1.5K	ALB	EB
R8107	0228 4030	film, 12K, 3W	CGW	LPI3
R8108	0203 0770	16K	ALB	EB
R8109	0203 0350	300	ALB	EB
R8111	0203 1650	100, ±10%	ALB	EB
R8112	0203 0860	39K	ALB	EB
R8113	0203 0900	56K	ALB	EB
R8114	0203 0930	75K	ALB	EB
R8115	0203 0860	39K	ALB	EB
R8116	0203 0890	51K	ALB	EB
R8117	0203 0450	750	ALB	EB
R8118	0203 0480	1K	ALB	EB
R8119	0203 0730	11K	ALB	EB
R8121	0203 0850	36K	ALB	EB
R8122	0234 9480	film, 62K, 1W	CGW	C32
R8123	0203 0890	51K	ALB	EB
R8124	0203 0910	62K	ALB	EB
R8125	0203 1650	100, ±10%	ALB	EB
R8126	0203 0950	91K	ALB	EB
R8127	0203 1080	330K	ALB	EB
R8128	0203 0960	100K	ALB	EB
R8129	0203 1440	10M	ALB	EB
R8130	0234 8450	film, 10K	CGW	C20
R8131	0203 1650	100, ±10%	ALB	EB
R8132	0203 0580	2.7K	ALB	EB
R8133	0109 1310	variable, 1.5K (SWP LENGTH)	CTS	45
R8134	0234 9200	4.3K, 1W	CGW	C32
R8135	0203 1080	330K	ALB	EB
R8136	0203 0840	33K	ALB	EB

Symbol	Part Number	Description	Recommended Vendor Code	Type
R8200	0203 2130	1M, ±10%	ALB	EB
R8201	0236 6930	film, 20K, ±1%	CGW	N20
R8202	0236 6720	film, 12.1K, ±1%	CGW	N20
R8203	0236 7480	film, 75K, ±1%	CGW	N20
R8204	0107 2901	variable, 50K/50K, ±20% (POSITION)	ABD	
R8205	0203 1020	180K	ALB	EB
R8206	0203 0900	56K	ALB	EB
R8207	0236 7600	film, 100K, ±1%	CGW	N20
R8208 & R8209	0203 1650	100, ±10%	ALB	EB
R8210	0228 6130	film, 900K, ±1%	ELC	DDM
R8211	0203 1000	150K	ALB	EB
R8212 & R8213	0203 0730	11K	ALB	EB
R8214 & R8215	0203 1650	100, ±10%	ALB	EB
R8216 & R8217	0236 6640	film, 10K, ±1%	CGW	N20
R8218	0236 6430	film, 6.04K, ±1%	CGW	N20
R8219	0236 5380	film, 487, ±1%	CGW	N20
R8220	0203 0960	100K	ALB	EB
R8221 & R8222	0203 0520	1.5K	ALB	EB
R8223	0203 0360	330	ALB	EB
R8224	0234 9190	film, 3.9K, 1W	CGW	C32
R8225	0203 0500	1.2K	ALB	EB
R8226	0109 2020	variable, 25K, ±20%, .2W (SWP CAL)	CTS	70
R8227	0203 0500	1.2K	ALB	EB
R8228	0203 0880	47K	ALB	EB
R8229	0109 1340	variable, 100K, ¼W (EXP BAL)	CTS	45
R8231	0203 0880	47K	ALB	EB
R8232 & R8233	0203 1650	100, ±10%	ALB	EB
R8234	0203 1610	47, ±10%	ALB	EB
R8235	0109 1330	variable, 2.5K (X AMP LEVEL)	CTS	45
R8236 & R8237	0234 9290	film, 10K, 1W	CGW	C32
R8238	0203 0380	390	ALB	EB
R8242 & R8243	0239 1401	film, 15K, 2W	ABD	
R8244 & R8245	0203 0760	15K	ALB	EB
R8301	0203 0790	20K	ALB	EB
R8302 (part of S830)	0107 2751	variable, 50K (VARIABLE)	ABD	
R8304 to R8306	0234 2270	film, 10M, ±1%	TEX	CD1/2SR
R8307	0234 2260	film, 6M, ±1%	TEX	CD1/2SR
R8308	0229 4950	film, 2M, ±1%	ELC	DC1/2B
R8309	0229 4990	film, 1M, ±1%	ELC	DC1/2B
R8311	0234 2100	film, 200K, ±1%	TEX	CD1/2SR
R8312	0234 2130	film, 600K, ±1%	TEX	CD1/2SR
R8313	0234 2100	film, 200K, ±1%	TEX	CD1/2SR
R8314	0203 1000	150K	ALB	EB
R8403	0237 0500	film, 43, 2W	CGW	C42S
R8404	0203 0640	4.7K	ALB	EB
R8405	0234 8690	film, 100K	CGW	C20
R8406	0234 8210	film, 1K	CGW	C20

SWITCHES

Symbol	Part Number	Description	Recommended Vendor Code	Type
S801	0503 2140	slide, DP3T (TRIG SOURCE)	MUT	5608
S802	0503 2140	slide, DP3T (TRIP COUPLING)	MUT	5608
S803	0503 1330	slide, DP2T (TRIG SLOPE)	STC	SS-50
S804 (part of R8013)	0107 2742			
S805	0501 7081	lever, 3 position (NORMAL/SINGLE/RESET)	ABD	
S820 (part of R8302)	0107 2751	SPDT (PULL/10X MAG)	ABD	
S830	0501 7111	rotary, 22 positions (TIME/DIV)	ABD	

ELECTRON TUBES

Symbol	Part Number	Description	Recommended Vendor Code	Type
V801 to V804	2501 2220	6DJ8/ECC88	AMX	
V805	2500 8590	12AL5	EIA	
V806	2500 8670	6BH6	EIA	
V820	2501 1610	ECC82/12AU7	AMX	

SECTION 4B
SPARE PARTS LIST

SPARE PARTS REQUIREMENTS

a. General

The Type 74-14 Time Base Plug-In is an extremely reliable and dependable instrument. Only components thoroughly tested and approved by the engineers of the Quality Assurance Department are used in this instrument. Continued performance tests, environmental and life testing of production units make certain your instrument will give many years of satisfactory service. These new Fairchild instruments are precision engineered and require no selected parts.

Two lists of "running spares" are included to aid you in periodic maintenance. The running-spare parts lists include recommended quantities and reference symbol numbers. Section 4A of this Instruction Manual gives a complete listing of all components and their recommended vendors so that you may readily procure them from a local supply house or your own stores.

Note: The local Fairchild Scientific Instrument Field Engineering representative and his service organization can assist you in obtaining any additional components in the shortest possible time. To help expedite service, always give Type Number and Serial Number of the instrument; always specify the part number and give a description of the component (see Section 4A of this manual).

b. 500-Hour Spares (6 months)

The recommended list for one through three units is given below.

Electron Tubes

Type	Quantity
V801	2
V805	1
V806	1
V820	1

Transistors

Type	Quantity
Q8201	1
Q8203	1

Diodes

CR8101	3

c. 2000-Hour Spares (2 years)

The recommended list for one through five units is given below. Maintain spares indicated plus one for each slug-in in use; 2 of each set of the 500-hour spare list given in paragraph (b) plus the quantities listed as follows:

Capacitors

Symbol	Quantity	Symbol	Quantity
C8001	1	C8206	1
C8002	1	C8207	1
C8003	1	C8209	1
C8004	2	C8301	1
C8006	1	C8302	1
C8007	1	C8303	1
C8101	1	C8304	1
C8102	1	C8305	1
C8103	1	C8306	1
C8106	1	C8307	1
C8201	1	C8401	1
C8202	1		

Lamp

Symbol	Quantity
DS8101	1

Electrical Connectors

J8001	2
P8001	1

Resistors

Symbol	Quantity	Symbol	Quantity
R8001	1	R8132	1
R8002	1	R8133	1
R8003	1	R8134	1
R8004	1	R8136	1
R8006	1	R8200	1
R8007	6	R8201	1
R8008	1	R8202	1
R8011	1	R8203	1
R8012	2	R8204	1
R8013	1	R8205	1
R8015	2	R8210	1
R8016	1	R8211	1
R8019	1	R8216	1
R8021	1	R8218	1
R8022	1	R8219	1
R8023	1	R8223	1
R8025	1	R8224	1
R8026	1	R8225	1
R8100	1	R8226	1
R8103	1	R8229	1
R8104	1	R8234	1
R8105	1	R8235	1
R8107	1	R8236	1
R8108	1	R8238	1
R8109	1	R8242	1
R8112	1	R8244	1
R8113	1	R8301	1
R8114	1	R8304	1
R8117	1	R8307	1
R8118	1	R8308	1
R8119	1	R8309	1
R8121	1	R8311	1
R8122	1	R8312	1
R8124	1	R8403	1
R8126	1	R8404	1
R8127	1	R8405	1
R8129	1	R8406	1
R8130	1		

Switches

Stock only one for each of the following switches for each 3 units being maintained:

S801, S803, S805, S830

NOTE: Should a particular switch receive more than normal use in certain applications (such as the NORMAL/SINGLE/RESET) then the quantity stocked of that particular switch should be doubled.

d. Miscellaneous

The following items may be stocked in quantities of one for each 2 units being maintained:

Name	Part Number
Knob, GP #3	4500 9035
Knob, round	4501 0350
Knob	4501 0431
Knob, small	4501 2022
Knob, medium	4501 2031
Guide, plug-in	5200 8941
Fastener, adjustable pawl	6401 7390

e. Summary

The quantities of spare parts given in the preceding paragraphs are intended for industrial and military duty under normal environment and heavy-use conditions. It is suggested that the maintenance engineer evaluate:

1. The conditions under which the instruments will be used.
2. The skill of the maintenance technicians.
3. Other similar items on hand.
4. The effect of procurement time of spares and effects of instrument down-time on your organization.

It is recommended that inventories of spare parts outlined above be adjusted according to the requirements of your own laboratory or plant.

In the first analysis, the factory recommends the availability of spares or standby equipments since extensive life testing of your instrument has shown no higher failure rate for any specific component.

LIST OF RECOMMENDED VENDORS

CODE	NAME
ABD	Du Mont Laboratories
AER	Aerovox Corporation
AHH	Arrow-Hart & Hegeman Electric Company
ALB	Allen-Bradley Company
ALC	Allied Control
ALCO	Alco Electronic Products
ALD	Alden Products Company
AMA	Amaton Electronic Hardware
AMP	Amp Inc.
AMR	Amperite Company, Inc.
AMX	Amperex Electronics Products, Inc.
APC	American Phenolic Corporation
APH	Amphenol Electronics Corporation
ARC	Arco Electronics Inc. (Elmenco)
AST	Astron Corporation
AUT	Automatic Metal Products Corporation
BEL	Belfuse
BNS	Bourns Inc.
BUR	Burndy Engrg. Company
BUS	Bussmann Mfg. Company
CAN	Cannon Electric Company
CBS	CBS-Hytron Division of CBS
CDE	Cornell-Dubilier Electric Corporation
CGW	Corning Glass Works
CH	Cutler-Hammer, Inc.
CHC	Chester Cable Corporation
CHM	Chatham Electronics
CIN	Cinch Manufacturing Company
CLS	Clarostat Mfg. Co., Inc.
COC	Continental Carbon
COM	Comar Electric
COW	Continental-Wirt Electronics Corporation
CPC	C. P. Clare & Company
CRL	Centralab, Division of Globe-Union, Inc.
CST	Chicago Standard Transformer Corporation
CTC	Cambridge Thermionic Corporation
CTS	Chicago Telephone Supply Corporation
DAG	Dage Electric Company, Inc.
DAL	Dale Products, Inc.
DLC	Dialight Corporation
DRK	Drake Mfg. Company
EBY	Hugh H. Eby, Inc.
EDL	Edal Industries
EIA	Any manufacturer meeting EIA standards
ELC	Electra Manufacturing Company
ELD	Eldema Corporation
EMC	Electro Motive Mfg. Company
EMW	Elmwood Sensors, Inc.
ERC	Erie Resistor Corporation
ESX	Essex Electronics
FAST	John E. Fast Company
FCI	Fairchild Camera and Instrument Corporation
FER	Ferroxcube Corporation of America
GDE	Good-All Electric Mfg. Company
GE	General Electric Company
GEN	General Instrument Corporation
GEP	General Products Corporation
GLB	Globe Industries
GRC	General Radio Company
GRY	Grayhill, Inc.
GUD	The Gudeman Company
HAM	The Hammarlund Manufacturing Co., Inc.

CODE	NAME
HON	Honeywell
HOP	Hopkins Engineering Company
HP	Hewlett-Packard Company
IEC	International Electronics Corporation
IRC	International Resistance Company
IRP	International Rectifier Corporation
ITT	ITT Components Division
JEF	Jeffers Electronics, Inc.
JHN	E. F. Johnson Company
JWM	J. W. Miller Company
KUL	Kulka Electric Mfg. Co. Inc.
KXM	Klixon Metals and Control Corporation
LED	Ledex Inc.
LEE	Leecraft Mfg. Company
LFI	Littlefuse, Inc.
LIN	Line Electric
MAL	P. R. Mallory & Company, Inc.
MCR	Micro Switch (Division of Minneapolis-Honeywell Regulator Co.)
MIC	Micamold Electronics Mfg. Corporation
MIL	Miller Electric Company
MOT	Motorola Semiconductor Products, Inc.
MOV	M-O Valve Company Ltd.
MUC	Mucon Corporation
MUT	The Muter Company
NYT	New York Transformer Company, Inc.
OAK	Oak Mfg. Company
PHC	Philco Corporation
PHI	Philips Electronic Tube Division
PLS	Plastoid Corporation
POT	Potter & Brumfield, Inc.
PRC	Precision Resistor Co., Inc.
PYR	Pyramid Electric Company
RCA	Radio Corporation of America
RMC	Radio Materials Corporation
ROY	Royal Electric Corporation, Inc.
RTN	Rotron Mfg. Company
SIG	Signalite Inc.
SIL	Silicon Transistor Corporation
SLT	Sealectro Corporation
SOL	Solitron Devices, Inc.
SPG	Sprague Electric Company
STC	Stackpole Carbon Company
STW	Standard Winding Company
SUM	Summit Coil Company
SWW	Stanwyck Winding Company
SYL	Sylvania Electric Products, Inc.
SYN	Syntronic Instruments, Inc.
TEC	Transistor Electronics Corporation
TEX	Texas Instruments, Inc.
THC	Thermal Control, Inc.
TOR	Torrington Mfg., Company
TRS	Tresco, Inc.
TRU	Tru-Ohm Products
TUG	Tung-Sol Electric Inc.
UCN	Ucinite Company
UTC	United Transformer Company
VIC	The Victoreen Instrument Company
WDE	Wood Electric Corporation
WDL	Ward Leonard Electric Company
WES	Weston Electrical Instrument Corporation
WYN	Welwyn International Inc.

INSTRUMENT WARRANTY AND SERVICE NOTICE

WARRANTY

The Scientific Instrument Department warrants that each new Cathode-ray Oscilloscope, Automotive Test Equipment, and other Electronic or Electrical Test or Measuring Equipment (hereinafter referred to as "Instrument") manufactured or sold by it, is free from defects in material or workmanship under normal use and service for a period of one year from the date of its sale to the first purchaser for use. If, upon examination by Fairchild, the Instrument is determined to be defective in workmanship or material, Fairchild will, subject to the conditions set forth below, either repair the defective part or replace it with a new part. Fairchild shall not be liable for any delay or failure to furnish a replacement part resulting directly or indirectly from any governmental restriction, priority or allocation or any other governmental regulatory order or action, nor shall Fairchild be liable for damages by reason of the failure of the Instrument to perform properly or for any consequential damages. This warranty does not apply to any Instrument that has been subject to negligence, accident, misuse or improper installation or operation or that in any way has been tampered with, altered or repaired by any person other than an authorized Fairchild service organization or an employee thereof, or to any Instrument whose serial number has been altered, defaced or removed, or to any Instrument purchased within, and thereafter removed beyond, the continental limits of the United States.

This warranty shall, at Fairchild's option, become void unless registration thereof is promptly effected as provided below. This warranty is in lieu of all other warranties, expressed or implied, and no one is authorized to assume any liability on behalf of Fairchild or impose any obligation upon it in connection with the sale of any Instrument, other than as stated above.

REGISTERING THE WARRANTY

To register this warranty, the enclosed warranty registration card must be properly filled out and mailed to the Instrument Service Department immediately upon receipt of the equipment. Complete information is necessary. BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD. Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

SERVICE

In order to insure service under our warranty, the enclosed warranty service card must be properly filled out and returned to the factory. In all cases where service or adjustment is requested, please first contact the factory or authorized depot, giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. THE TYPE NUMBER AND SERIAL NUMBER of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing to the factory in this respect, address:

FAIRCHILD
Instrumentation
Scientific Instrument Dept.
750 Bloomfield Avenue, Clifton, New Jersey

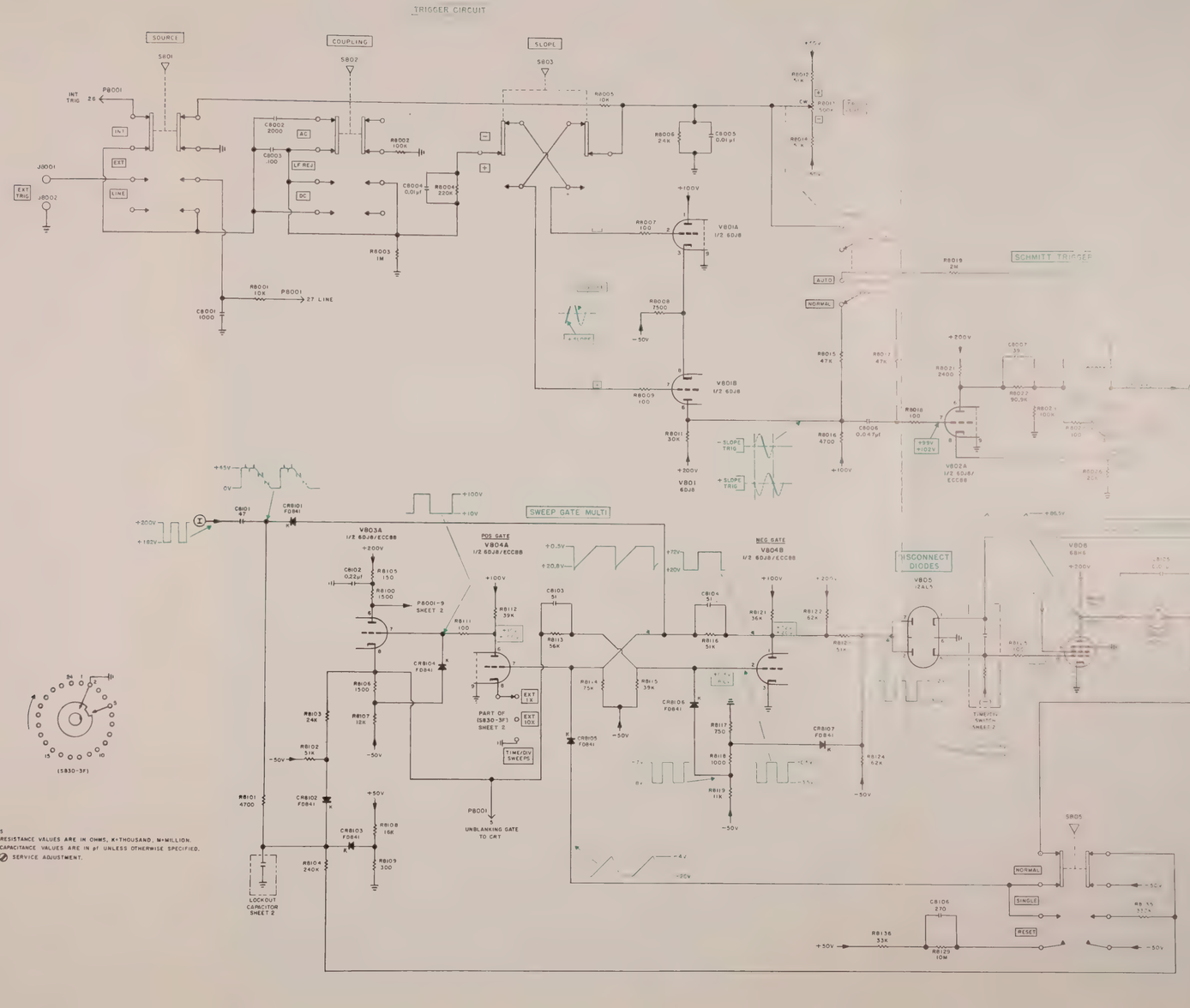
The Instrument Service Department will then send to the customer the written procedure for disposition and shipping instructions. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

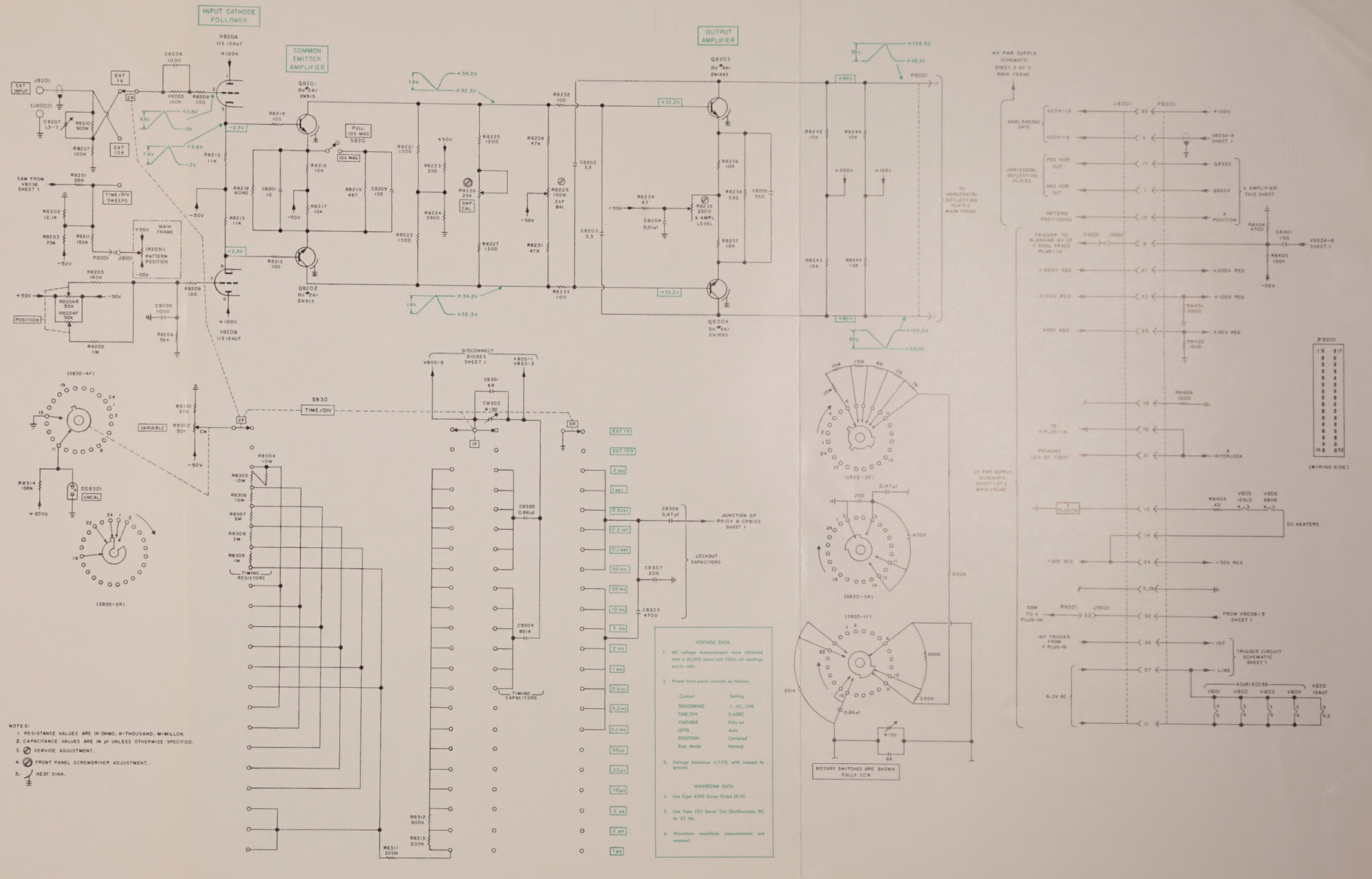
REPLACEMENT PARTS

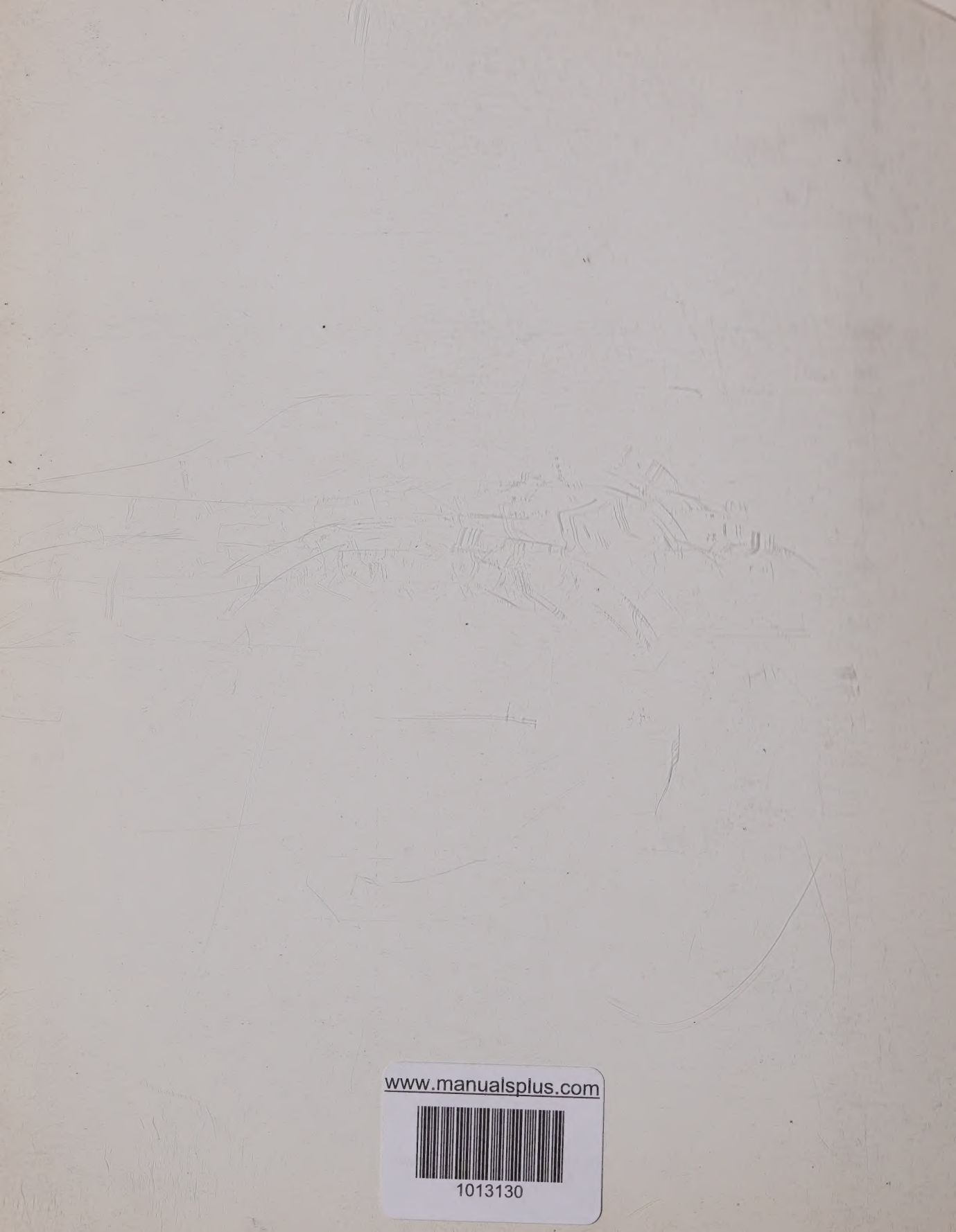
If it is necessary to order a replacement component from the factory, always give the Type number and Serial number of the Instrument. Before ordering parts for in-warranty replacement or purchasing them for out-of-warranty replacement, be sure to consult the Parts List in the Instruction Manual. The Parts List gives the values, tolerances, ratings, and Fairchild part number for all electrical components used in the Instrument. This will help to expedite service.

PATENT NOTICE

Manufactured under one or more U. S. Patents owned or controlled by Fairchild Camera and Instrument Corporation, 750 Bloomfield Avenue, Clifton, New Jersey, U.S.A. Patent Numbers supplied upon request.


TRIGGER CIRCUIT
SOURCE
COUPLING
SLOPE
S801
S802
S803
INT. TRIG
INT
EXT
LINE
EXT TRIG
J8001
J8002
P8001
AC
LF REJ
DC
SCHMITT TRIGGER
AUTO
NORMAL
V801A 1/2 6DJ8
V801B 1/2 6DJ8
V801 6DJ8
V802A 1/2 6DJ8/ECC88
SLOPE TRIG
+SLOPE TRIG
SWEEP GATE MULTI
V803A 1/2 6DJ8/ECC88
POS GATE
V804A 1/2 6DJ8/ECC88
NEG GATE
V804B 1/2 6DJ8/ECC88
DISCONNECT DIODES
V805 12AL5
V806 6BH6
V803B 1/2 6DJ8/ECC88
P8001-9 SHEET 2
PART OF (5830-3F) SHEET 2
EXT 1X
EXT 10X
TIME/DIV SWEEPS
UNBLANKING GATE TO CRT
LOCKOUT CAPACITOR SHEET 2
TO TIME/DIV SWITCH SHEET 2
SWEEP LENGTH
S805
NORMAL
SINGLE
RESET
(5830-3F)
NOTES
1. RESISTANCE VALUES ARE IN OHMS, K=THOUSAND, M=MILLION.
2. CAPACITANCE VALUES ARE IN pf UNLESS OTHERWISE SPECIFIED.
3. SERVICE ADJUSTMENT.


INPUT CATHODE FOLLOWER
COMMON EMITTER AMPLIFIER
OUTPUT AMPLIFIER
V820A 1/2 12AU7
V820B 1/2 12AU7
Q8201 DUAL 2N915
Q8202 DUAL 2N915
Q8203 DUAL 2N1893
Q8204 DUAL 2N1893
J8201 EXT INPUT
EXT 1X
EXT 10X
PULL 10X MAG
10X MAG
SAW FROM V8038 SHEET 1
TIME/DIV SWEEPS
MAIN FRAME
(R2031) PATTERN POSITION
POSITION
VARIABLE
5830 TIME/DIV
DISCONNECT DIODES SHEET 1
V805-5
V805-1
V803-3
(5830-4F)
(5830-2R)
(5830-2F)
(5830-3R)
(5830-1F)
DS8301 UNCAL
TIMING RESISTORS
TIMING CAPACITORS
LOCKOUT CAPACITORS
JUNCTION OF R8104 & CR8103 SHEET 1
EXT 1X
EXT 10X
2 sec
1 sec
0.5 sec
0.2 sec
0.1 sec
50 ms
20 ms
10 ms
5 ms
2 ms
1 ms
0.5 ms
0.2 ms
0.1 ms
50 µs
20 µs
10 µs
5 µs
2 µs
1 µs
TO HORIZONTAL DEFLECTION PLATES MAIN FRAME
ROTARY SWITCHES ARE SHOWN FULLY CCW
HV PWR SUPPLY SCHEMATIC SHEET 2 OF 2 MAIN FRAME
LV PWR SUPPLY SCHEMATIC SHEET 1 OF 2 MAIN FRAME
P8001
(WIRING SIDE)
UNBLANKING GATE
HORIZONTAL DEFLECTION PLATES
POS HOR OUT
NEG HOR OUT
PATTERN POSITIONING
X AMPLIFIER THIS SHEET
X POSITION
TRIGGER TO BLANKING W/ OF Y DUAL TRACE PLUG-IN
+200V REG
+100V REG
+50V REG
-50V REG
TO Y PLUG-IN
PRIMARY LEG OF T1001
X INTERLOCK
DC HEATERS
SAW TO Y PLUG-IN
FROM V8038-3 SHEET 1
INT TRIGGER FROM Y PLUG-IN
INT
LINE
TRIGGER CIRCUIT SCHEMATIC SHEET 1
6.3V AC
6DJ8/ECC88
VOLTAGE DATA
WAVEFORM DATA
NOTES:
1. RESISTANCE VALUES ARE IN OHMS; K=THOUSAND, M=MILLION.
2. CAPACITANCE VALUES ARE IN pf UNLESS OTHERWISE SPECIFIED.
3. SERVICE ADJUSTMENT.
4. FRONT PANEL SCREWDRIVER ADJUSTMENT.
5. HEAT SINK.



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